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NORTHERN REGIONAL RESEARCH LABORATORY

PUBLICATIONS AND PATENTS

July-December 1973

**Agricultural Research Service
DEPARTMENT OF AGRICULTURE**

U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH SERVICE
ORGANIZATION DIRECTORY

Mr. Talcott W. Edminster
Administrator, ARS-USDA
Administration Building, USDA
Washington, D.C. 20250

Dr. H. Rex Thomas
Deputy Administrator
USDA-ARS-Western Region
2850 Telegraph Avenue
Berkeley, California 94705
Telephone: (415) 841-5121

Western Region covers Arizona,
California, Colorado, Hawaii,
Idaho, Montana, Nevada, New
Mexico, Oregon, Utah, Washington,
Wyoming.

Dr. Arthur W. Cooper
Deputy Administrator
USDA-ARS-Southern Region
P.O. Box 53326
New Orleans, Louisiana 70153
Telephone: (504) 527-6753

Southern Region covers Alabama,
Arkansas, Florida, Georgia,
Kentucky, Louisiana, Mississippi,
North Carolina, Oklahoma, Puerto
Rico, South Carolina, Tennessee,
Texas, Virgin Islands, Virginia.

Mr. Earl R. Glover
Deputy Administrator
USDA-ARS-North Central Region
2000 W. Pioneer Parkway
Peoria, Illinois 61614
Telephone: (309) 673-9577

North Central Region covers
Alaska, Illinois, Indiana, Iowa,
Kansas, Michigan, Minnesota,
Missouri, Nebraska, North Dakota,
Ohio, South Dakota, Wisconsin.

Dr. Steven C. King
Deputy Administrator
USDA-ARS-Northeastern Region
Room 333, Administration Building
Agricultural Research Center, West
Beltsville, Maryland 20705
Telephone: (301) 344-3418

Northeastern Region covers
Connecticut, Delaware, Maine,
Maryland, Massachusetts, New
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Northern Regional Research Laboratory
Agricultural Research Service
United States Department of Agriculture
1815 North University Street
Peoria, Illinois 61604

REQUEST FOR INFORMATION

Results of research investigations at the Northern Regional Research Laboratory are published regularly in the technical literature, and public-service patents are secured to cover patentable inventions and discoveries (see page 64). As a convenient guide to our publications and patents, a list with abstracts is published semiannually. These abstracts describe the current research and indicate the progress achieved. Further information on any of the developments, as well as earlier technical papers, may be obtained by writing us.

In conformance with the policy of the U.S. Department of Agriculture, Northern Laboratory publications are available to scientists and other specialists, librarians, representatives of the press, and others interested.

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Most of the publications are in journals that are available in libraries. Photographic copies of most journal articles on research at this Laboratory can be purchased from the National Agricultural Library of the U.S. Department of Agriculture, Beltsville, Maryland 20705.

No publications will be sent regularly in response to foreign requests unless exchange arrangements have been made with the Director of the National Agricultural Library.

Copies of previous lists of publications and patents are available upon request.

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JULY-DECEMBER 1973

PUBLICATIONS

[Publications marked with an asterisk (*) are not available for distribution at the Northern Regional Research Laboratory. When requesting reprints, please order by number. Use your zip code.]

3330 • Incidence of Aflatoxin in Southern Corn, 1969-1970
O. L. Shotwell, C. W. Hesseltine, and M. L. Goulden
Cereal Sci. Today 18(7): 192-195. July 1973

Sixty samples from all grades except U.S. No. 1 were collected by grain inspectors of Agricultural Marketing Service from areas in the South and assayed for aflatoxin. Corn from these areas accounts for only 4% of the total yearly production in the U.S. None of 12 samples of the 1969 crop collected in the Southeast contained aflatoxin, but 14 of 22 samples of the 1970 crop in the same area were aflatoxin positive. Corn in this area was infected with southern corn leaf blight in 1970, but there is insufficient evidence to establish a definite relation between blight and aflatoxin occurrence. The 60 samples included both white and yellow corn. Four of the 11 white corn samples assayed contained aflatoxins in levels from 6 to 141 p.p.b. B-1. Two of these samples had more than 20 p.p.b. B-1, the guideline level (141, 42 p.p.b. B-1). The positive samples were in U.S. grade Nos. 4 and 5, with the highest levels in U.S. grade No. 5. Seventeen of the 49 yellow corn samples analyzed contained aflatoxins (4 to 308 p.p.b. B-1). Ten of these had more than 20 p.p.b. B-1 (308, 124, 114, 98, 83, 61, 62, 62, 31, 25 p.p.b. B-1). The yellow corn samples with the highest levels of aflatoxin were in the poorest grades. *Aspergillus flavus* was easily isolated from all positive samples. As a result of this study, the Food and Drug Administration intensified its program on monitoring corn for aflatoxin. Another outcome of the study was the initiation of two surveys of corn and corn meal by the Grain Division, Agricultural Marketing Service.

3331 • Mercury Removal from Waste Water with Starch Xanthate-Cationic Polymer Complex
Charles L. Swanson, Robert E. Wing, William M. Doane,
and Charles R. Russell
Environ. Sci. Technol. 7(7): 614-619. July 1973

Sequential addition of starch xanthate and a cationic polymer [*e.g.*, poly(vinylbenzyltrimethylammonium chloride) or polyethylenimine] to a

mercury solution forms a precipitate that is removed by filtration. The amount of xanthate required to precipitate the cationic polymer and mercury is determined by streaming current measurement. Variables include streaming current potential, degree of substitution of the starch xanthate, level of cationic polymer added, initial mercury(II) concentration, initial pH of the mercury(II) solution, sodium chloride concentration, rate of xanthate addition, biochemical oxygen demand after treatment, and the effect of divalent ions or sequestrants. Residual mercury concentrations were as low as 3.8 $\mu\text{g/l}$. after single treatment of solutions that had initial mercury(II) concentrations of $1.0 \times 10^5 \mu\text{g/l}$.

3332 • Mill Evaluation of Dialdehyde Starch-Protein Glue
for Hardwood Plywood Manufacture

F. B. Weakley, W. B. Roth, C. L. Mehltretter,
and J. W. Kennicott¹

(¹Panoply Corporation, Lexington, Tenn.)

Forest Prod. J. 23(7): 44-48. July 1973

A hot-press dialdehyde starch-protein (DAS-protein) glue was evaluated under mill conditions for use in Type II hardwood plywood manufacture. Test results on 576 three-ply, 48-inch by 96-inch birch panels fabricated with the experimental glue showed that the glue bond has good tolerance to such manufacturing variables as veneer moisture content, glue spread, closed-panel assembly time, and panel hot-press time. Type II plywood glue bonds were satisfactory except where glue spread was purposely reduced to inadequate levels. Data indicate that steam blows encountered in some phases of the tolerance study can be eliminated or reduced to acceptable levels by using feasible low hot-press temperatures, glue spreads, and hot-press times. The glue exhibited no unusual or undesirable characteristics in mill usage. Furthermore, bleed-through of any consequence was not observed when manufacturing birch panels having 1/26-inch thick outer plies. Certain substantial advantages of the experimental glue over traditional adhesives were demonstrated.

3333 • A New Dialkylresorcinol from *Stemphylium majuscum*

Frank H. Stodola, David Weisleder, and Ronald F. Vesonder
Phytochemistry 12(7): 1797-1798. July 1973

In a survey of species of *Stemphylium* a new compound, stemphol, was isolated from *S. majuscum*, and its 2,5-dialkylresorcinol structure was established.

3334 • *Nocardia acidophilus*--Not an *Actinomycetales*
T. G. Pridham and A. J. Lyons
Develop. Ind. Microbiol. 14: 200-204. 1973

In 1970, Canham *et al.* (*Mycologia*, 62:599-603) presented evidence that *Nocardia acidophilus* most probably is a Basidiomycete. In characterizing progeny of the original isolate by minimal routine methods recommended for *Actinomycetales*, we place the organism in Morphological Section Unknown, Color Series White. No diaminopimelic acid (DAP) isomers were found when whole-cell hydrolyzates were subjected to paper chromatography. Presence of either the meso or D-isomer of DAP, or both, is a distinguishing diagnostic feature of many genera of *Actinomycetales*, including *Nocardia* Trevisan. Therefore, absence of any DAP in whole-cell hydrolyzates provides additional confirmation to the evidence presented by Canham *et al.*.

3335 • Utilization of Carbon Compounds by *Helminthosporium maydis* and *H. carbonum*
J. J. Ellis, G. A. Bennett, and C. W. Hesselton
Mycologia 65(3): 539-547. May-June 1973

Five strains of *Helminthosporium maydis* Nisik. et Miyake and two strains of *H. carbonum* Ullstrup were grown on 14 carbohydrates and 13 fatty acids each as the sole carbon source. All carbohydrates except L(-)-sorbose supported excellent growth. Fatty acids having 12 or more carbon atoms supported growth of all strains except *H. carbonum* Race II, which failed to grow on linolenic acid. Optimum growth of strain NRRL 5128 *H. maydis* Race T in shaken culture occurred within 7 days at 28° C. Under these conditions this strain utilized 45-55% corn oil when incorporated into the medium at 5% by volume as the sole carbon source.

3336 • Standard Antimicrobial Spectra as Aids in Characterization and Identification of *Actinomycetales*
A. J. Lyons and T. G. Pridham
Develop. Ind. Microbiol. 14: 205-211. 1973

Antimicrobial spectra produced under standardized conditions served as primary criteria for categorizing several thousand *Actinomycetales*. Each strain was tested by a simple spectrum-dish technique for its ability to inhibit the growth of *Bacillus subtilis* (Ehrenberg) Cohn, *Sarcina lutea* Schroeter, *Escherichia coli* (Migula) Castellani and Chalmers, *Saccharomyces pastorianus* Hansen, *Candida albicans* (Robin) Burk., and *Mucor ramannianus* Moel. Based on qualitative and quantitative aspects of inhibition of the bacteria involved, 12 antibacterial patterns were established. Strains in each antibacterial pattern were subdivided into eight categories based on two criteria: darkening of peptone-iron agar and spore-wall ornamentation. Although no subdivision of antifungal patterns was made, some speculation on the chemical nature of the antifungal activity represented by a

particular pattern could be made. Also, the overall inhibition patterns suggested that some reasonable speculations could be made with reference to the presumptive identification of some antibiotic activities. This simple aid serves as an initial step to define more precisely the qualitative nature of antibiotics produced by *Actinomycetales*.

3337 • Ochratoxin and Penicillic Acid in Tumorigenic and Acute Toxicity Tests with White Mice

L. A. Lindenfelser, E. B. Lillehoj, and Melba S. Milburn
Develop. Ind. Microbiol. 14: 331-336. 1973

Two mycotoxins, alone and in mixtures of various proportions, were tested for their ability to promote skin tumors by the two-stage tumor-induction process; 9,10-dimethyl-1,2-benzanthracene served as a control promotion agent. Neither ochratoxin nor penicillic acid contributed to papilloma development in a strain of mice sensitive to skin tumor. However, tests of the toxins administered intraperitoneally, both singly and in various combinations, established acute LD₅₀ toxicities of 24 mg./kg. for ochratoxin and 70 mg./kg. for penicillic acid. Mixtures of the two substances produced a synergistic lethal response.

3338 • Possible Outbreaks of Fusariotoxicosis in Avians

R. D. Wyatt,¹ J. R. Harris,¹ P. B. Hamilton,¹ and H. R. Burmeister
(¹North Carolina State University, Raleigh)
Avian Dis. 16(5): 1123-1130. October-December 1972

A disease syndrome characterized by raised yellowish-white lesions in the oral cavity was observed in several commercial broiler flocks. Growth rates were depressed, and 10% died. Fowl pox was ruled out by infectivity tests in susceptible birds with lesion material. A similar outbreak occurred in fancy pigeons fed visibly moldy feed. The oral lesions in pigeons contained large numbers of avirulent *Staphylococcus epidermidis* and *Escherichia coli*. Identical oral lesions were produced in the laboratory by feeding chickens small concentrations of fusariotoxin T-2 produced by the fungus *Fusarium tricinctum*.

3339 • Cyclopropenoic Acids of *Pavonia sepium* Seed Oil

R. V. Madrigal and C. R. Smith, Jr.
Lipids 8(7): 407-409. July 1973

The seed oil of *Pavonia sepium* (Malvaceae) contains sterculic (7%) and malvalic (4%) acids. Countercurrent distribution in a hexane-acetonitrile system concentrated and resolved the homologous cyclopropenoic methyl esters. Reductive ozonolysis of selected countercurrent distribution fractions gave β -diketoesters, which were identified by gas chromatography-mass spectrometry as derivatives of sterculic and malvalic acids. *Pavonia sepium* is the first known species in the plant family Malvaceae whose seed oil contains more sterculic than malvalic acid.

3340 • A Condensed Methyl Reductic Acid from Hydrolysis
of Amino-Hexose-Reductones

Frank D. Mills, John E. Hodge, William K. Rohwedder,
and Larry W. Tjarks

J. Org. Chem. 38(14): 2512-2517. July 1973

Dilute mineral acid hydrolyzes the amino group of hexose-reductones to yield 26% of a new yellow reductone, 2-hydroxy-2-(2',3'-dihydroxy-5'-methyl-2'-cyclopentenon-5'-yl)-4-methyl-4-cyclopentene-1,3-dione. The structure is assigned from ultraviolet, infrared, mass spectral, and proton magnetic resonance data. Chemical evidence supporting the condensed methyl reductic acid structure was obtained from periodate and hydrogen peroxide oxidations; 2-methyl-(Z)-butenedioic acid and 2-carboxy-2-methylbutanedioic acids were identified. Reduction of the yellow reductone and acetylation of the mixture produce the diacetate of methyl reductic acid, the di- and triacetates of unreacted yellow reductone, and the mixed acetates of the partially reduced parent material. These products were also identified by spectral techniques and confirmed by comparisons with data from authentic compounds whenever possible.

3341 • Collaborative Study of Three Screening Methods for
Aflatoxin in Corn

Odette L. Shotwell and Robert D. Stubblefield

J. Ass. Off. Anal. Chem. 56(4): 808-812. July 1973

The three rapid screening methods studied all involved chromatography of partially purified extracts on minicolumns. In one method acetonitrile-water is used to extract aflatoxin from corn and a lead-acetate precipitation removes impurities from the extracts. The second method specifies acetone-water as the extracting solvent and ammonium sulfate as the precipitant. The third method is based on acetone-water as the extracting solvent and ferric gel as the precipitant. The most sensitive method was the ferric gel precipitation, which could detect 5 p.p.b. aflatoxin, but it was very time consuming. The most satisfactory method (timewise) used the ammonium sulfate and had a sensitivity of 10 p.p.b. This method also led to the best differentiation between levels of aflatoxin. These two methods have been adopted as official first action.

3342 • Modified Rapid Screening Method for Aflatoxin in Corn

Gail M. Shannon, Robert D. Stubblefield, and Odette L. Shotwell

J. Ass. Off. Anal. Chem. 56(4): 1024-1025. July 1973

A rapid screening method for detecting aflatoxin in cottonseed products was investigated to determine if it was applicable to corn. Other aflatoxin-extracting solvents and protein-precipitating agents were tried with white and yellow corn. When acetone-water (85+15) and a saturated solution of ammonium sulfate were substituted for acetonitrile-water (80+20) and lead

acetate in the cottonseed method, fewer interferences and more compact fluorescent zones were observed on the developed minicolumns. The modified method for corn was applicable to samples containing 10 p.p.b. or more aflatoxin.

3343* • PDP-8/I-IBM 1800 Mass Spectrometry System
D. J. Wolf, W. K. Rohwedder, R. O. Butterfield,
and H. J. Dutton
Proc. COMMON Meeting, Detroit, Mich., pp. 449-458.
April 24-27, 1973

A PDP-8/I minicomputer, 500 feet from an IBM 1800, collects and pre-processes low- and high-resolution mass spectra. The IBM 1800 performs mathematical calculations that convert gauss or time to mass and normalizes intensities. The PDP-8/I, as a communicator to the IBM 1800, allows input of options; transmits mass spectra; and receives back mass-marked spectra for display on a memory scope. Mass spectra are recorded on magnetic tape by the IBM 1800 for later hardcopy processing. Gas chromatographic-mass spectrometric scans are automatically repeated for an extended period with a minimum turn around time of 6 seconds. A library of five unknown spectra can be compared to the library of known spectra in about 4 minutes. A listing of matches is printed in descending order of similarity index. A series of supportive programs maintains and implements the mass spectral system and the PDP-8/I and IBM 1800 intercommunication.

3344 • Poly(amide-acetals) and Poly(ester-acetals) from
9(10)-Formylstearic Acid as Stationary Phases
for Gas Chromatography
W. E. Neff, R. A. Awl, E. H. Pryde, and J. C. Cowan
J. Amer. Oil Chem. Soc. 50(7): 235-239. July 1973

Diesters from the reaction product of methyl 9(10)-formylstearate with pentaerythritol were condensed with diols and diamines to produce the respective linear poly(ester-acetals) and poly(amide-acetals). Like those derived from methyl azelaaldehydate, these polymers have latent crosslinking sites at the acetal bond and, when crosslinked on an acidic diatomaceous support, form useful stationary phases bonded to the support surface for gas chromatography. Unlike that derived from methyl azelaaldehydate, the linear poly(amide-acetal) from methyl 9(10)-formylstearate is soluble in solvents, so that column packings are more easily prepared and advantage can be taken of the more polar nature of the poly(amide-acetal). The stationary phases derived from the formylstearate have a continuous operating range from at least -60° C. to 190°-220° C. with no

detectable amount of phase bleed. Bleeding gradually increases, but the packings are still useful in dual column, compensated systems to 290° C. The poly(amide-acetal) derived from formylstearate has intermediate polarity, whereas the poly(ester-acetal) counterpart is relatively non-polar. Polarity of the poly(ester-acetal) was greatly increased, whereas that of the poly(amide-acetal) was slightly lowered by adding dimethyl 1,4-cyclohexanedicarboxylate as a comonomer. Compounds of widely different polarities were separated with good resolution and adequate efficiency on these packings during programmed or isothermal gas chromatography.

3345 • Water-Recycle Washing of Refined Soybean Oil: Plant Scale Evaluation
R. E. Beal, L. T. Black, E. L. Griffin, J. C. Meng,¹ and G. S. Farmer²
(¹Anderson Clayton Foods, Sherman, Texas; ²Anderson Clayton Foods, Dallas, Texas)
J. Amer. Oil Chem. Soc. 50(7): 260-263. July 1973

A series of 24-hour tests was made in a commercial refinery under eight different operating conditions to select optimum conditions for a subsequent longer test of the antipollution recycle-washing process wherein wash water is recycled instead of being discarded. Alkali-refined oil was continuously washed at a rate of 15,000 pounds per hour to remove sodium. Recycled wash water was then treated with a cation exchange resin to remove sodium. Two wash water pH levels, two oil-water ratios, and the addition of a sequestering agent ethylene diamine tetraacetic acid (EDTA) to wash water were factors investigated. For the longer test a water pH of 3.0 and an oil-water ratio of 4:1 were used, and EDTA was not added. Operating and analytical data, equipment specifications, and cost data were acquired. The washed oil had a satisfactorily low content of sodium, iron, and copper. After it was bleached the oil hydrogenated at a rate comparable to that of a conventionally washed oil. The bleached, deodorized oil had satisfactory flavor and flavor stability. The exchange resin required periodic caustic cleaning to maintain capacity. The new recycle process provides an economic solution to the wash water disposal problem.

3346 • The Challenge of Waste Utilization
G. E. Inglett
In "Symposium: Processing Agricultural and Municipal Wastes," ed. G. E. Inglett, chap. 1, pp. 1-5. Westport, Conn. 1973

The increasing population on earth is responsible for the increasing problem of waste disposal and utilization. No longer can the solution

to pollution be dilution. The assemblage of large concentrations of people, animals, and manufactured goods, including automobiles, creates waste problems. These wastes must be adequately disposed or utilized.

The amount of agricultural waste produced annually is about 60% of the total solid waste production from all segments of our society. Agricultural crop waste amounts to 550 million tons per year (15 pounds/capita/day). Animal waste amounts to 1.56 billion tons per year (43 pounds/capita/day). The total agricultural solid waste is 2.11 billion tons per year (58 pounds/capita/day). This total is six to eight times the amount generated from the municipal sector.

3347 • Processing Animal Wastes for Feed and Industrial Products
J. H. Sloneker, R. W. Jones, H. L. Griffin, K. Eskins,
B. L. Bucher, and G. E. Inglett
In "Symposium: Processing Agricultural and Municipal Wastes," ed. G. E. Inglett, chap. 3, pp. 13-28. Westport, Conn. 1973

By a simple screening process, approximately 70% of the total nitrogen can be recovered from feedlot waste as a potential feed fraction containing 35-40% protein and representing approximately 40% of the total waste solids. The remaining bulky fiber fraction can be converted into a cheap, nonodorous ingredient for fiberboardlike products. Alternatively, the fiber fraction and solubles can be recombined and used as a fermentation substrate for the cellulolytic fungus, *Trichoderma viride*. Studies with whole manure and the fibrous fraction indicate that more than 25% of the organic matter is digested by the fungus with complete retention of the nitrogen. The remaining solids, which can be readily recovered, are also a potential source of feed protein. Furthermore, the cellulolytic-hemicellulolytic enzyme complex isolated from the fermentation liquor serves as an additive that will increase feed digestibility and efficiency.

3348* • Paper and Paperboard from Cellulosic Byproducts
Dwight L. Miller
In "Symposium: Processing Agricultural and Municipal Wastes," ed. G. E. Inglett, chap. 11, pp. 119-128. Westport, Conn. 1973

Future use of nonwood agricultural cellulosic fibers as a paper and paperboard raw material is expected to increase substantially. These fibers now account for about 3% of the total pulp and paper production in the United States or about 1.6 million tons per year. Domestic wood shortages are forecast in some regions within the next decade. Current and developing restrictions on burning grass and cereal straws have increased the need

to channel such raw materials into the manufacture of paper and paperboard. Cereal straws, sugarcane bagasse, kenaf, reeds, and grasses are now used commercially in many foreign countries where wood is in short supply. Quality papers and boards are being prepared from them, and all operations are technically feasible. Generally throughout the U.S., dependable supplies at prices competitive with wood have not been available. Required environmental control and technical advances in collecting and handling will affect the future course of action.

3349 • Bright Greenish-Yellow Fluorescence and Associated Fungi in White Corn Naturally Contaminated with Aflatoxin
D. I. Fennell, R. J. Bothast, E. B. Lillehoj, and R. E. Peterson
Cereal Chem. 50(4): 404-414. July-August 1973

Good correlation was observed between the presence of *Aspergillus flavus* Link ex Fr., a bright greenish-yellow (BGY) fluorescence, and aflatoxin in a naturally contaminated white corn. However, *A. flavus* was observed on nonfluorescent whole undamaged kernels that assayed at <20 p.p.b. and on nonfluorescent whole damaged kernels and fragments that assayed at 3,000 p.p.b. Whole damaged kernels that failed to fluoresce externally yielded some fluorescing fragments when coarse ground. Routinely, BGY fluorescence in whole corn was observed on the face of the kernels immediately above the germ, and in sectioned kernels the emission was generally restricted to a narrow region outlining the germ. Usually, initial development of *A. flavus* was confined to the germ region. Isolates of *A. flavus* from aflatoxin-contaminated corn could be separated into four groups on gross cultural characteristics. Two of four isolates selected as representative of these groups exhibited aflatoxin-production capability, whereas all four synthesized kojic acid, the presumed precursor of the BGY fluorescence.

3350 • Corn Germ Protein Isolate--Preliminary Studies on Preparation and Properties
H. C. Nielsen, G. E. Inglett, J. S. Wall, and G. L. Donaldson
Cereal Chem. 50(4): 435-443. July-August 1973

Commercial corn germ was extracted with hexane and ground to a meal. Protein was solubilized by two extractions in a high-speed blender at either a 10:1 or a 5:1 solvent:meal ratio. The first solvent was water containing 10 mg. sodium hydroxide per gram germ meal (pH 8.7); the second was water only. Protein in the extract was precipitated by adjusting to isoelectric pH (4.7). The protein precipitate, after being washed with water, was adjusted to pH 7.0 and freeze-dried. The neutralized isolate extracted at a 5:1 solvent:meal ratio was dialyzed against distilled

water for 48 hours to reduce ash content before freeze-drying. Proximate analysis of the dialyzed isolate was 74% protein (N X 5.4); 4.3% ash, most of which was phosphate; and 0.08% fiber. The protein in the isolate contains 6% lysine with a good balance of other essential amino acids. Mild flavor, light tan color, solubility at neutral and low pH, and ability to stabilize an oil-in-water emulsion are some properties of this corn-germ protein isolate that indicate its potential for many food uses.

3351 • Sorghum Protein Ultrastructure as it Relates to Composition
H. L. Seckinger and M. J. Wolf
Cereal Chem. 50(4): 455-465. July-August 1973

The ultrastructure of endosperm protein from seven hybrids and eight experimental lines was studied with both transmission and scanning electron microscopes. Vitreous endosperm shows a well-developed two-component structure consisting of protein bodies embedded in a matrix protein. The aqueous alcohol-soluble fraction (prolamine) proved to be the major component of globular protein bodies. The surrounding matrix protein consisted mostly of glutelin. Globular protein bodies have a nucleus that is insoluble in aqueous alcohol.

Protein bodies of almost all grain sorghums were 2 to 3 μm . in diameter. One experimental line with above-average lysine content had smaller protein bodies, a condition which verifies the negative correlation between prolamine and lysine.

Distribution of protein within the sorghum kernel is similar to that of other cereal grains. The peripheral vitreous area of the kernel is rich in protein; interior areas have smaller amounts of protein. Microscopic observations show that protein bodies make up the major part of sorghum endosperm protein.

3352 • Oat Protein Concentrates from a Wet-Milling Process:
Preparation
J. E. Cluskey, Y. V. Wu, J. S. Wall, and G. E. Inglett
Cereal Chem. 50(4): 475-481. July-August 1973

A wet-milling process was developed to produce protein concentrates, starch, and residue fractions from dry-milled oat varieties having moderate- (Wyndmere) and high-protein contents (Garland). Different solvents and pH's were evaluated for their effectiveness in extracting an oat protein concentrate in good yield. The optimum yield of protein was obtained in dilute alkali solution (pH 9). Starch and protein were separated from bran by sieving the alkaline dispersion. After the fine

suspension was centrifuged to separate pure starch (0.05% nitrogen), the protein solution was adjusted to pH 6 and freeze-dried. The protein content (nitrogen X 6.25) of the concentrate varied between 59 and 89%, depending on the dry-milled fraction and process used, and accounts for up to 88% of total protein in the starting material. This simple process for producing an oat protein concentrate may have commercial potential.

3353 • Oat Protein Concentrates from a Wet-Milling Process:
Composition and Properties

Y. V. Wu, J. E. Cluskey, J. S. Wall, and G. E. Inglett
Cereal Chem. 50(4): 481-488. July-August 1973

Protein concentrates, starch, and residue fractions produced by a wet-milling process from ground oat groats with moderate- and high-protein contents were analyzed for amino acid composition, protein, starch, fat, fiber, ash, and various neutral carbohydrates. The concentrates, which have a bland taste, contain from 59 to 75% protein (nitrogen X 6.25) with 3.9 to 4.1 grams of lysine and 3.3 to 4.3 grams of total sulfur amino acids per 16 grams of nitrogen. The concentrates are low in fiber (0.1 to 0.2%), have 3.5 to 4.5% ash, no starch, and from 2.2 to 23.3% total carbohydrate. Protein concentrate from Garland groats has 10.1% fat, whereas defatted Wyndmere groats give a protein concentrate with 0.3% fat. The starch fraction is essentially composed of pure starch without any other carbohydrate. Protein concentrate from defatted Garland groats has a nitrogen solubility of 83% at pH 2.1, a minimum solubility (15%) around pH 5, and 95% solubility at pH 11.⁴.

3354 • Protein Concentrates from Oat Flours by Air Classification
of Normal and High-Protein Varieties

Y. V. Wu and A. C. Stringfellow
Cereal Chem. 50(4): 489-496. July-August 1973

Oat groats, as well as first and second flours, from a high-protein variety (Garland) and from a normal-protein variety (Sioux) were finely ground and air-classified to yield fractions with protein contents (nitrogen X 6.25) ranging from 4 to 88%. Air classification of the oat flours produced a unique fraction (83 to 88% protein) not previously observed for wheat, rye, corn, sorghum, or triticale flours. This fraction (2 to 5% by weight) accounted for 14, 16, and 7%, respectively, of the total protein in first and second flours and groats. The next fraction (25 to 29% by weight) with 15 to 39% protein accounted for total protein from flours of 38 to 48%, and with 21 to 29% protein from groats, 31 to 33%. The first and second flours gave a better air-classification response than ground groats, and the high-protein variety gave better results than normal-protein oats. Amino acid analysis of all fractions indicated high-lysine levels from 3.9 to 5.0 grams per 16 grams of nitrogen and adequate total sulfur amino acids. Data showed that air classification of oat flours and ground groats produced protein concentrates of good amino acid composition and could provide a new food ingredient suitable for a variety of uses.

3355 • Deuteration of Methyl *cis*-9,*cis*-15-Octadecadienoate with Nickel Catalyst
S. Koritala and H. J. Dutton
J. Amer. Oil Chem. Soc. 50(8): 307-309. August 1973

Methyl *cis*-9,*cis*-15-octadecadienoate was partially deuterated with nickel catalyst, and the product was separated into saturate, monoene, and diene fractions. Monoenes were separated into *trans* and *cis* fractions, and dienes into *trans, trans*, *cis, trans*, and *cis, cis* fractions. Monoene isomers with double bonds at the 9 and 15 positions predominated in both *cis*- and *trans*-monoene fractions. Considerable amounts of isomers with double bonds situated on either side of the original 9 and 15 positions were found in the *trans*-monoene fraction. Diene was extensively isomerized to positional and geometrical isomers, and deuterium was incorporated into these isomers. Double bond migration was greatest in *trans, trans*-dienes and smallest in *cis, cis*-dienes. The amount of deuterium in the dienes was proportional to the extent of isomerization experienced by the dienes.

3356 • Deuteration of Methyl Linoleate with Nickel, Palladium, Platinum and Copper-Chromite Catalysts
Sambasivarao Koritala, E. Selke, and H. J. Dutton
J. Amer. Oil Chem. Soc. 50(8): 310-316. August 1973

Samples taken during deuteration of methyl linoleate with the title catalysts were separated into saturate, monoene, and diene fractions. Monoenes were further separated into *cis* and *trans* fractions. A comparison of the double bond distribution in monoenes with those from hydrogenation of alkali-conjugated linoleate indicated that up to 59% of the linoleate was reduced through a conjugated intermediate with nickel catalyst. The respective percentages for palladium and platinum catalysts were 51 and 23. Copper catalysts have previously been shown to reduce linoleate solely through conjugated intermediates. Copper-chromite catalyst showed infinite selectivity for the reduction of linoleate, because stearate did not form. The decreasing order of various catalysts for the selective reduction was copper-chromite>>>Ni at 195° C.>Pd>Ni at 100° C.>Pt. Computer simulation of platinum reduction indicated that ca. 20% of the linoleate was directly reduced to stearate through a shunt. Geometrical isomers of linoleate were formed during reduction with all catalysts except copper-chromite. Nickel catalyst formed both *trans, trans*- and *cis, trans*-isomers, as well as nonconjugatable dienes. These isomers were favored at the higher temperature and deuterium was incorporated into them. Palladium and platinum did not isomerize linoleate to nonconjugatable dienes. Because conjugated dienes are more reactive than linoleate, they were not found in appreciable amounts during reduction. Conjugated dienes were the only isomers formed

with copper-chromite catalyst. Deuterium was found in these conjugated dienes, which were also extensively isomerized. As a result of isomerization and exchange during reduction of linoleate--as well as further exchange between deuterium and monoenes--a wide distribution of isotopic isomers in monoenes was found with nickel, palladium, and platinum catalysts. Since isomerization of monoenes with copper-chromite is negligible, the isotopic distribution of monoenes must be due to exchange of intermediate conjugated dienes followed by addition.

3357 • Kinetics of Hydrogenation of Conjugated Triene and Diene with Nickel, Palladium, Platinum and Copper-Chromite Catalysts
S. Koritala, R. O. Butterfield, and H. J. Dutton
J. Amer. Oil Chem. Soc. 50(8): 317-320. August 1973

A mixture of methyl linoleate and alkali-conjugated methyl linoleate was reduced with nickel, palladium, platinum, and copper-chromite catalysts. The course of hydrogenation was followed by gas-liquid chromatography of samples withdrawn at intervals. Relative rate constants of reactants and intermediates were calculated by a computer. Conjugated linoleate was 10 to 18 times more reactive than methyl linoleate with all catalysts except platinum, which showed no selectivity at 60° C. At 150° C. conjugated diene reacted four times faster than methyl linoleate with platinum catalyst. A conjugated diene-to-stearate shunt was observed with palladium and platinum catalysts.

When β -eleostearate was hydrogenated with the same catalysts, 50 to 97% of the triene was reduced directly to monoene with all catalysts except copper chromite, which selectively reduced conjugated triene to conjugated diene. On the basis of present kinetic data and previous knowledge about the mode of hydrogen addition to conjugated systems, a scheme has been proposed to account for the products formed during hydrogenation of methyl linolenate.

3358 • Polyurethane Foams from Hydroxymethylated Fatty Diethanolamides
T. H. Khoe, F. Otey, E. N. Frankel, and J. C. Cowan
J. Amer. Oil Chem. Soc. 50(8): 331-333. August 1973

Satisfactory rigid polyurethane foams were prepared from diethanolamides of hydroxymethylated oleate, linseed oil, safflower oil, and their methyl esters. These foams were improved when the fatty polyols were blended with a commercial, low-molecular-weight polyol.

3359 • Starch Xanthide-Encased Rubbers

T. P. Abbott, W. M. Doane, and C. R. Russell
Rubber Age 105(8): 43-49. August 1973

Alcohol dehydration of starch xanthide (SX)-encased rubber is a useful method for producing powderlike crumb. The method is applicable to essentially all polymers available in latex form. The SX-encasing network breaks up on shearing into small reinforcing particles. Using 20 phr SX-SBR 1502 as a base compound rather than slab SBR 1502 affects properties only slightly for several formulations.

Injection molding of a shoe heel formulation based on 20 phr SX-SBR 1502 demonstrated that little machine adjustment was necessary to produce a smooth well-knit trivet. Initial extrusion studies have shown that increased shear work on a sample is necessary to gain maximum physical properties. Increased shear has been applied by restricting the die opening and by extruding samples through several passes.

Maximum physical properties are more easily achieved in low viscosity compounds containing clay filler than in low viscosity compounds containing reinforcing carbon black filler. Further work is planned wherein modified screw action will serve to introduce additional shear work into the SX-powder blend.

3360 • Publications and Patents of the Northern Regional Research Laboratory, January-June 1973

U.S. Agr. Res. Serv., Unnumb. Pub., 53 pp. [August 1973]

3361 • Sources and Management of Micro-Organisms for the Development of a Fermentation Industry

C. W. Hesseltine and W. C. Haynes
Progr. Ind. Microbiol. 12: 1-46. 1973

This review of microorganisms provides a background for the manufacture of chemicals by fermentation. Investigations are being conducted at the Northern Regional Research Laboratory on the industrial utilization of cereal grains, oilseeds, and agricultural wastes by fermentation. The ARS Culture Collection, maintained there, is one of the world's most complete collections of industrially important bacteria, molds, actinomycetes, and yeasts. It serves as a source of authentic microorganisms for the fermentative production of organic acids, vitamins, antibiotics, enzymes, feeds, beverages, and foods. Inasmuch as the key to success or failure in most fermentative processes is availability of the proper microorganisms, the

characteristics of suitable microbial strains are enumerated; the industrial microbial collections of the world--their locations, their general holdings, and the names of their directors--are listed. The attributes of a good culture collection are emphasized. Various fermentation processes in use throughout the world are listed, together with the specific microorganisms needed to carry them out. Of these processes, the ones most likely to be beneficial in developing countries are indicated. Information is included on problems of maintaining stable cultures, on how small fermentation plants may acquire suitable microbial strains, and on how microorganisms can be shipped through international channels.

3362 • Synthesis of Methyl 4,6-O-Methylene-D-glycopyranosides
 James C. Goodwin and John E. Hodge
 Carbohyd. Res. 28(2): 213-219. June 1973

Methyl 4,6-O-methylene-D-glycopyranosides having the α -D-*altro*, α - and β -D-*gluco*, α -D-*manno*, and α -D-*galacto* configurations were prepared in 3.4 to 27.4% yields by condensing formaldehyde from 1,3,5-trioxane with the methyl glycosides in anhydrous 1,4-dioxane at 95° with boron trifluoride as the catalyst. A crystalline methyl 2,3:4,6-di-O-methylene- α -D-mannopyranoside was also isolated. Crystalline methyl 4,6-O-methylene 2,3-di-O-p-tolylsulfonyl- α -D-*galacto*- and α -D-*glucopyranosides were prepared in 78 and 54.4% yields. Nuclear magnetic resonance coupling constants of the 2,3-di-O-acetyl derivatives of the 4,6-O-methylene glycosides were used to establish the Cl(D) conformation for each derivative.*

3363 • An Extracellular Microbial Polysaccharide Composed of 2-Acetamido-2-deoxy-D-glucose and 2-Acetamido-2-deoxy-D-glucuronic Acid: Radiochemical and Gas-Chromatographic Analysis of the Products of Methanolysis
 Paul A. Sandford, Paul R. Watson, and Allene R. Jeanes
 Carbohyd. Res. 29(1): 153-164. July 1973

When the polysaccharide from the black yeast NRRL Y-6272, composed of 2-acetamido-2-deoxy-D-glucose (GNAc) and 2-acetamido-2-deoxy-D-glucuronic acid (GNAcUA), is hydrolyzed, extensive humin formation occurs by decomposition of component residues, especially the hexosaminuronic acid. Methanolysis avoids this decomposition by forming stable methyl glycosides amenable to quantitation by both radiochromatographic techniques and gas chromatography. Unlike hydrolysis, which results in incomplete depolymerization, refluxing methanol-HCl (M , 16-24 hours) completely depolymerizes polysaccharide Y-6272 to the methyl glycosides of its component sugars.

Use of ^{14}C -methanol-HCl allows quantitation of GNAc and GNAcUA by counting the individual ^{14}C -methyl glycosides after separation by paper chromatography. As the methyl glycosides derived from the hexosaminuronic acid in polysaccharide Y-6272 consist of both a methyl ester and a lactone, for quantitation it was necessary to convert these two glycoside forms into a common derivative of known ^{14}C -methyl content by treatment with mild alkali.

Methanolysis by using radioisotopes affords an extremely valuable method for detecting and quantitating amino sugars in polysaccharides; it is rapid and sensitive and it should be especially applicable for analyzing other polysaccharides and proteins that contain constituents labile to normal hydrolytic conditions.

3364 • Viriditoxin Production by *Aspergillus viridi-nutans* and Related Species
E. B. Lillehoj and M. S. Milburn
Appl. Microbiol. 26(2): 202-205. August 1973

Bioproduction of viriditoxin on various substrates by strains of the *Aspergillus fumigatus* group was determined under several incubation conditions. *A. viridi-nutans* strains NRRL 4365 and NRRL 576 produced the largest quantities of toxin, *A. brevipes* gave reduced yields, and there was no detectable synthesis by isolates of four related species. After 30 days in static culture at 20° C. on various autoclaved agricultural commodities, optimal yields of 440 and 380 mg. of toxin were observed per kilogram of sorghum and rice. Toxin levels were reduced on corn, rye, and wheat (40-200 mg./kg.); yields were low on cottonseed, barley, and oats. Incubation at 10° C. restricted biosynthesis of viriditoxin, and no toxin accumulated on substrates maintained at 5° C. for 120 days. In a liquid, yeast extract-sucrose medium, maximum mycotoxin production developed in shake flasks; after 156 hours, 10 mg. of toxin accumulated per gram of mycelium. Viriditoxin produced in submerged culture was associated with the mycelium; less than 1% was detected in the filtered broth after 156 hours of incubation.

3365 • Biological Functions of Multistable Proteins
Kenneth W. Nickerson
J. Theor. Biol. 40(3): 507-515. August 1973

Multistable proteins are defined as those that have available more than one most stable conformation. This capability requires a reversal of the most stable and metastable designations dependent upon environmental conditions. The concept of multistability is discussed with regard to enzyme maturation, hybrid vigor, metabolic temperature compensation, developmental gradients, membrane transport, and the classic theory of allostery.

3366* • Stability of Carotenoids in the Kernels of Maize

C. O. Grogan¹ and C. W. Blessin(¹Cornell University, Ithaca, N.Y.)

Can. J. Plant Sci. 53(3): 507-510. July 1973

Cytoplasmic male (T) sterility, nitrogen treatment, and plant density did not influence significantly the xanthophylls and carotenes in maize (*Zea mays* L.) kernels. In only one of two single crosses was a difference in xanthophylls indicated as being due to kernel position on the ear. As a whole, the carotenoid pigments appear to possess a reasonably good buffered system with little variation in content under a variety of pre-harvest influences. These results are of particular significance in the production of high-carotenoid maize for feedstuff and in breeding for increased carotenoid content.

3367 • New Proteins from Oats

James E. Cluskey, Y. Victor Wu, A. C. Stringfellow

Joseph S. Wall, and George E. Inglett

Food Eng. 45(8): 99-100, 102. August 1973

Another source of proteins processed from oats has been developed by USDA researchers. One group consists of protein concentrates which, along with starch and residue fractions, are produced from ground oat groats by wet-milling. The other comprises high-protein fractions from air-classified finely ground oat groats and flours (first and second).

These bland oat proteins have solubility, hydration capacity, and emulsion stability that suggest their uses in foods and beverages.

3368 • Hydrogen Sulfide Adducts of Methyl Oleate and Linoleate

A. W. Schwab, W. K. Rohwedder, L. W. Tjarks, and L. E. Gast

J. Amer. Oil Chem. Soc. 50(9): 364-366. September 1973

Sulfur compounds derived from photochemical addition of hydrogen sulfide to methyl oleate and linoleate were separated by preparative gas chromatography. The major compounds were investigated by nuclear magnetic resonance, mass, and infrared spectroscopy and by elemental analysis. The primary product of the methyl oleate reaction was methyl 9(10)-mercaptopstearate. Gas chromatograms of the product from methyl linoleate showed four principal peaks. From mass spectra and nuclear magnetic resonance data, we identified methyl 9-(2-pentyl-1-thiolan-5-yl)nonanoate, methyl 8-(2-hexyl-1-thiolan-5-yl)octanoate, and methyl 9-(3-hexyl-1,2-dithiolan-5-yl)nonanoate. Evidence for the formation of methyl mercapto-octadecenoates and methyl dimercaptostearates was also obtained.

3369 • Mycotoxin-Producing Strains of *Penicillium viridicatum*:
Classification into Subgroups
A. Ciegler, D. I. Fennell, G. A. Sansing, R. W. Dstroy,
and G. A. Bennett
Appl. Microbiol. 26(3): 271-278. September 1973

In all, 52 isolates of *Penicillium viridicatum* Westling were divided into three groups based on ability to produce either ochratoxin or citrinin, or both, as well as their color, growth rate, type of growth, odor, and isolation source. Members of group I resemble one of the representative strains of *P. viridicatum* described in the literature; those belonging to group II differ from group I strains in several characteristics; group III is a heterogeneous series of highly variable isolates. Although three subgroupings can be recognized, retention of all isolates in the species *P. viridicatum* is deemed most appropriate at this time. Spore macerates of all isolates were examined for viruslike particles, but none were detected.

3370 • Viability of *Actinomycetales* Stored in Soil
T. G. Pridham, A. J. Lyons, and B. Phrompatima
Appl. Microbiol. 26(3): 441-442. September 1973

About 1,800 *Actinomycetales* stored in soil for up to 20 years were checked for viabilities. About one-half were viable.

3371 • Seeds of *Indigofera* Species: Their Content of Amino Acids
That May Be Deleterious
Roger W. Miller and Cecil R. Smith, Jr.
J. Agr. Food Chem. 21(5): 909-912. September-October 1973

To provide information about their suitability as forage crops, several *Indigofera* species have been examined for possible deleterious constituents. The occurrence of indospicine (2-amino-6-amidinohexanoic acid) and other free amino acids in extracts of seeds from 17 different species of *Indigofera* was determined by thin-layer and ion-exchange chromatography. The hepatotoxic and teratogenic amino acid, indospicine, was detected only in *I. endecaphylla*, the species from which it had been isolated originally. Complete amino acid composition (excluding tryptophan) of defatted seed meal of three species (*I. endecaphylla*, *I. pilosa*, and *I. schimperi*) was determined. A basic amino acid of unknown structure and unknown physiological properties was detected in two species (*I. schimperi* and *I. oblongifolia*).

3372 • Potential Juvenile Hormone Activity: Preparation of Fatty
β-Methylcrotonyl and 3,4-Methylenedioxyphephenyl Derivatives
Edward W. Bell, Lyle E. Gast, John C. Cowan, John P. Friedrich,
and William S. Bowers¹
(¹Entomology Research Division, Beltsville, Maryland)
J. Agr. Food Chem. 21(5): 925-926. September-October 1973

Certain compounds with β-methylcrotonyl and 3,4-methylenedioxyphephenyl groups are known to possess juvenile hormone activity because they prevent insect maturation and reproduction. A series of compounds containing these groups has been prepared from fatty acids and their derivatives. These chemicals showed little or no juvenile hormone activity at 10-100 µg./insect in the yellow mealworm, *Tenebrio molitor* L. Of the compounds tested an isomeric mixture of β-methylacrylates from linseed oil-derived C₁₈ aromatic cyclic acids showed the greatest activity.

3373 • Sensitized Photodegradation of Cellulose and Cellulosic Wastes
K. Eskins, B. L. Bucher, and J. H. Sloneker
Photochem. Photobiol. 18(3): 195-200. September 1973

The photodegradation of cellulose and cellulose-containing waste sensitized by a variety of dyes was measured by means of viscosity, tensile strength, and scanning electron microscopy. Anthraquinone-2-sulfonate and proflavin dihydrochloride were both more effective than either rose bengal or methylene blue for degradation. Samples degraded by these dyes were similar in appearance to enzyme-degraded ones, but were less susceptible to further degradative action by enzymes.

3374 • Aflatoxin M₁ in Milk: Evaluation of Methods
Robert D. Stubblefield, Gail M. Shannon, and Odette L. Shotwell
J. Ass. Off. Anal. Chem. 56(5): 1106-1110. September 1973

Six published methods for the determination of aflatoxin M₁ in liquid and powdered milk were compared because a quantitative assay sensitive to 0.1 µg./liter was needed for routine analysis. Each method was tested with both spiked and naturally contaminated samples at levels of 0.1, 0.5, and 1 µg./liter or 1, 5, and 10 µg./kg.; recoveries of M₁ were determined. Data revealed that two methods, one for liquid milk and one for powdered milk, had the desired sensitivity and recoveries. In the liquid milk method, M₁ is extracted and milk protein is precipitated simultaneously with methanol-water (4+1); in the powdered milk method, M₁ is extracted with acetone-water (70+30) and milk protein is then precipitated with a lead acetate solution. Both methods remove fats from the aqueous acetone

or methanol solutions with hexane before partition of M_1 into chloroform. Aflatoxin M_1 is determined by thin-layer chromatography of the chloroform extracts and either visual or densitometric measurement of mycotoxin on thin-layer plates. Modifications were made to simplify the methods and to reduce the time required to complete the assays.

3375 • Characterization of the Dominant Aerobic Microorganism
in Cattle Feedlot Waste
G. R. Hrubant
Appl. Microbiol. 26(4): 512-516. October 1973

The dominant microorganism in cattle feedlot waste (FLW) is a corynebacterium. It is ubiquitous to FLW except on sites where antibiotics are a constant part of the animals' diet. The organism requires DL-aspartic acid as its nitrogen source for growth, and individual strains also require or are stimulated by L-tyrosine; acetate serves as the carbon source. Amylolytic activity is weak; protease, lipase, and cellulase activities are nil. Despite the abundance of the organism, it probably does not decompose the waste appreciably.

3376 • Solubilization and Selected Properties of Crambe Seed
Thioglucosidase (Thioglucoside Glucohydrolase, EC 3.2.3.1)
H. L. Tookey
Can. J. Biochem. 51(9): 1305-1310. September 1973

Ultrasonic treatment releases thioglucoside glucohydrolase (thioglucosidase) from insoluble particles of *Crambe abyssinica* seed meal. The crude enzyme is optimally activated by $10^{-2} M$ ascorbate, requires a reducing agent for stability, and is inhibited by $10^{-3} M$ *p*-chloromercuribenzenesulfonate.

Chromatography of a meal extract on crosslinked dextran separates two enzyme fractions. About 80% of the activity elutes at an apparent molecular weight of 110,000; the remainder elutes at the void volume. Both crude soluble enzyme and the fractions from the dextran column produce goitrin from *epi*-progoitrin, but in the presence of ferrous ion, the chief aglucon product becomes 1-cyano-2-hydroxy-3-butene. The Michaelis constant (of the major peak) at pH 5 is 0.004 M . Ferrous ion produces substrate inhibition at high *epi*-progoitrin levels. Sequential fractionation of meal extract by ammonium sulfate precipitation and by chromatography on crosslinked dextran effects an 80-fold purification.

3377 • Formation of Extracellular C₁₄-C₁₈ 2-D-Hydroxy Fatty Acids by Species of *Saccharomyces*
C. P. Kurtzman, R. F. Vesonder, and M. J. Smiley
Appl. Microbiol. 26(4): 650-652. October 1973

Out of 19 strains of *Saccharomyces fibuligera* 18 produced mixtures of C₁₄-C₁₈ 2-D-hydroxy acids in liquid culture medium, as well as one of two strains of *S. capsularis*. The mixture of these acids showed bacteriostatic activity against *Vibrio tyrogenus* but not against the other microorganisms tested. *Candida lactosa*, a recently described species, was shown to be an isolate of *S. fibuligera*.

3378 • Ionization of Carbohydrates in the Presence of Metal Hydroxides and Oxides
J. A. Rendleman, Jr.
Advan. Chem. Ser. 117: 51-69. 1973

Metal hydroxides interact rapidly and reversibly with carbohydrates to form metal hydroxide-carbohydrate adducts and, through hydroxylic proton abstraction, to form alcoholates. The formation of an alcoholate, or oxyanion, is an essential step in numerous inter- and intramolecular reactions of polyhydroxy compounds. Bases also attack aldehydo and keto sugars to give carbanions that are precursors for isomerization, epimerization, internal oxidation and reduction, and group migration. Carbohydrate acidity can be explained in terms of statistical factors, electrostatic field effects, polar group interactions, intramolecular hydrogen bonding, steric hindrance, and entropy of ionization.

3379 • Effect of Alkaline-Earth Metal Salts on Flocculence in *Saccharomyces cerevisiae*
Neil W. Taylor and William L. Orton
J. Inst. Brew. (London) 79(4): 294-297. July-August 1973

Flocculation in three strains of *Saccharomyces cerevisiae* is inhibited by two classes of ionic substances: (1) the alkaline-earth metal ions Sr and Ba, and (2) Ca complexing substances. Sr appears to be competitive with Ca in the flocculence mechanism because the extent of inhibition depends mainly on the ratio of Sr and Ca concentrations. The observations imply that the Ca requirement for flocculation is by a specific, unique process, and not by the commonly presumed charge neutralization or Ca salt-bridging mechanism.

3380 • Serine Dehydratase from Bacteria

G. E. N. Nelson, R. E. Peterson, and A. Ciegler
J. Appl. Bacteriol. 36(2): 245-247. June 1973

One hundred seventeen strains of bacteria were assayed for L-serine dehydratase activity. *Proteus vulgaris* NRRL B-123 yielded about 200 international units of dehydratase per gram dry weight.

3381 • Carbohydrate Metabolism in *Agrobacterium tumefaciens*

Larry O. Arthur, Lee A. Bulla, Jr., Grant St. Julian,
and Lawrence K. Nakamura
J. Bacteriol. 116(1): 304-313. October 1973

The activity of pentose cycling (PC) reactions in *Agrobacterium tumefaciens* is much greater than that normally found in bacteria, and in this regard the organism represents a unique category. Equations are presented that have been specifically derived for bacteria with high PC activity in the presence of an alternate pathway. *A. tumefaciens* utilizes D-glucose by strictly aerobic mechanisms involving the Entner-Doudoroff (ED) and PC pathways; relative participation by the ED pathway is 55% and by PC, 44%. The 3-ketoglycose-synthesizing system in the bacterium does not affect the relative participation of these two pathways. Radiorespirometric and enzymatic analyses clearly demonstrate that the Embden-Meyerhof-Parnas pathway does not function. Studies on the oxidation of pyruvic, acetic, succinic, and glutamic acids show that terminal respiration includes both the tricarboxylic acid and glyoxylic acid cycles.

3382 • Aflatoxin-Associated Fluorescence in Grain. Its Color Photography

R. E. Peterson and E. B. Lillehoj
Cereal Sci. Today 18(10): 343-344. October 1973

Because of the comparatively low intensity of most ultraviolet lamps (even the regular "high-intensity" type), long exposures and large apertures are usually necessary for macrophotography. Utilizing an electronic flash as an ultraviolet light source effectively eliminates problems such as image deterioration by camera movement and shallow depth of field. This simple method of photographically recording aflatoxin-associated fluorescence was applied successfully to corn kernels.

3383 • Medical Examination of Humans Exposed to *Bacillus popilliae* and *Popillia japonica* During Production of Commercial Milky Disease Spore Dust

A. M. Heimpel¹ and G. R. Hrubant

(¹Plant Protection Institute, ARS, USDA, Beltsville, Md.)

Environ. Entomol. 2(5): 793-795. October 1973

Bacillus popilliae Dutky and *Popillia japonica* Newman have been used in commercial production of milky disease spore dust for 26 years. The overall health of the people who produce the spore dust has not been adversely affected by prolonged exposure to this insect pathogen, and findings of recent clinical and physical examinations of personnel were within normal ranges for sex and age. In addition, antibodies to *B. popilliae* and *P. japonica* were not detected in their sera.

3384 • Isolation and Characterization of Gliadin-Like Subunits from Glutenin

J. A. Bietz and J. S. Wall

Cereal Chem. 50(5): 537-547. September-October 1973

The polypeptide subunits of wheat glutenin obtained after reductive cleavage of disulfide bonds have been separated into two fractions by a modified Osborne technique. Approximately 62% of the subunits by weight are soluble, as is gliadin, in neutral 70% ethanol; the ethanol-soluble subunits are mainly of 44,000 molecular weight (MW). The ethanol-insoluble glutenin subunit fraction is markedly different in amino acid composition, and consists of high-MW subunits, and some of lower MW. Sodium dodecyl sulfate electrophoresis, starch-gel electrophoresis, and amino acid analyses suggested that some ethanol-soluble subunits of reduced glutenin may be equivalent to subunits of high-MW gliadin. To test this possibility, both fractions were reduced and alkylated and 44,000-MW subunits were isolated and partially characterized.

3385 • Acylated Steryl Glucosides from Soybean Globulins: Isolation and Characterization

W. J. Wolf and B. W. Thomas

Cereal Chem. 50(5): 580-589. September-October 1973

Previous studies at the Northern Laboratory showed that isolated soybean proteins contain materials extractable with aqueous alcohols consisting of phosphatides, saponins, β -sitosteryl glucoside, genistein, triglycerides, and unidentified compounds. We have now identified acylated sterol

glucosides as an additional fraction of the materials extractable with 86% (v./v.) ethanol from freeze-dried acid-precipitated soybean globulins. The dry solids extracted from soy proteins with alcohol were leached with hexane, and the portion soluble in hexane was chromatographed on an activated magnesium silicate column. Yields of acylated steryl glucosides were 0.06% of the weight of the protein. The acylated steryl glucosides were characterized by thin-layer chromatography, hydrolysis to steryl glucosides, and analyses of fatty acids, sterols, and glucose. Although the fatty acids included 26% linoleic and 2% linolenic acid, the intact acylated steryl glucosides were not oxidized by the Theorell preparation of soybean lipoxygenase.

3386 • Pinnatanine and Oxpinnatanine, Novel Amino Acid Amides from *Staphylea pinnata* L.

M. D. Grove, D. Weisleder, and M. E. Daxenbichler
Tetrahedron 29(18): 2715-2719. September 1973

Two novel amino acid amides, pinnatanine and oxypinnatanine, have been isolated from *Staphylea pinnata* L. Their respective structures have been established as N⁵-(2-hydroxymethylbutadienyl)-L-*allo*-γ-hydroxy-glutamine and N⁵-(3-hydroxymethyl-2,5-dihydro-2-furyl)-L-*allo*-γ-hydroxy-glutamine by spectral methods and chemical degradation.

3387 • NMR Investigations of Rotenoids

D. G. Carlson, D. Weisleder, and W. H. Tallent
Tetrahedron 29(18): 2731-2741. September 1973

Extensive nuclear magnetic resonance (NMR) studies of major rotenoids have (1) verified the *cis* B/C ring fusion of rotenone; (2) confirmed the structure of the reduction-dehydration product of rotenone; (3) provided considerable evidence regarding the preferred conformations of rotenoids; (4) revealed an array of long-range couplings; and (5) pointed up analytically useful solvent effects. Incidentally, these studies also allowed assignment of NMR signals for essentially all protons of the major rotenoids in deuteriochloroform.

3388 • A Pulping Technique for Agricultural Fibers

A. J. Ernst and T. F. Clark
IPPTA 10(1): 29-32. January-March 1973

Laboratory experiments were conducted to determine the influence of chemical concentration and pressure on the mechano-chemical pulping of wheat straw and sugarcane bagasse. At atmospheric pressure, a Dynopulper produced pulps having characteristics similar to pulps produced in a Hydrapulper. Maximum lignin was removed and bleach requirements were

minimum when pressure in a Dynopulper ranged from 25 to 30 p.s.i.; however, efficiency of lignin removal per unit of applied pulping chemical decreased with increases in pressure. This technique of applying pressure produces readily bleachable pulps while retaining the advantages of the mechano-chemical process.

3389 • Ascocarps of *Aspergillus stromatoides*, *A. niveus*, and *A. flavipes*
 B. J. Wiley¹ and D. I. Fennell
 (¹U.S. Army Natick Laboratories, Natick, Mass.)
Mycologia 65(4): 752-760. July-August 1973

Previously unknown ascosporic states of *Aspergillus stromatoides* Raper & Fennell, *A. niveus* Blochwitz, and *A. flavipes* (Bain. & Sart.) Thom & Church, are described from several strains recently isolated from Thailand soils. Cleistothecia of *A. stromatoides* are like those of the *A. cremeus* group. Ascocarps of *A. niveus* resemble those of the *A. nidulans* group. The perfect state of *A. flavipes* is similar to that described for *A. rehmii* Zukal.

3390 • Kinetics of Grafting Acrylonitrile onto Starch
 L. A. Gugliemelli, C. L. Swanson, and W. M. Doane
J. Polym. Sci. 11(10): 2451-2462. October 1973

Acrylonitrile (AN) was graft copolymerized onto gelatinized and granular wheat starch in aqueous media in the presence of ceric ammonium nitrate initiator at 91-364 anhydroglucose units (AGU) per cerium(IV) and at 1.08-4.33 AN to AGU ratios. Molecular weights and dispersities of polyacrylonitrile side chains were determined by gel-permeation chromatography. Conversion-time plots of AN polymerizations in both gelatinized and granular starch systems show characteristics common to heterogeneous polymerizations that could be explained on the basis of buried polymer radicals. The rates of polymerizations were directly related to the square root of the corrected cerium(IV) concentration and to the 1.3 power of the AN concentration. Graft copolymerization of AN onto starch, at least during initial stages, is not suitably explained by a kinetic scheme involving termination by polymer radical with cerium(IV) ion.

3391 • Ethoxylated Glycerol and Propylene Glycol Glycoside Palmitates from Lactose
 C. L. Mehltretter and C. A. Wilham
J. Amer. Oil Chem. Soc. 50(10): 425-426. October 1973

Polyoxyethylene polyol glycoside palmitates were prepared by the following successive reactions: transglycosylation of lactose by glycerol and

propylene glycol to yield crude mixtures of the polyol glucosides and galactosides; alkoxylation with ethylene oxide; and transesterification by methyl palmitate. Almost all the solid waxy products exhibited low surface and interfacial tensions and good emulsion stability; they are expected to be effective food emulsifiers, cosmetic surfactants, and biodegradable industrial surfactants.

3392 • Soybean Protein Flavor Components: A Review

J. C. Cowan, J. J. Rackis, and W. J. Wolf

J. Amer. Oil Chem. Soc. 50(10): 426A, 428A, 430A, 432A,
434A, 435A, 444A. October 1973

This review on the flavor components of soybean protein products examines primarily our studies on sensory evaluation of commercial flours, concentrates, and isolates; on extraction of flavor components from soybean flakes with hexane-alcohol azeotropic mixtures; on the application of proteolytic enzymes to improve flavor; and on the effect of inactivating lipoxygenase on soy beverage flavor. Evidence indicates that enzymatic reactions affect the flavor of final products. Presumably lipoxygenase is a primary culprit and linolenic acid a primary precursor when soybeans are partially processed before destroying enzymatic activity.

3393 • Computer Monitoring of a Mini-Refinery

E. D. Bitner, J. O. Ernst, and H. J. Dutton

J. Amer. Oil Chem. Soc. 50(11): 436-439. November 1973

A laboratory-scale pilot plant is under construction so that problems involved in computer control of vegetable oil processing can be studied. Unit operations planned for this mini-refinery are continuous alkali-refining, bleaching, hydrogenating, and deodorizing. The alkali-refining step, similar to the Swedish "Zenith" process, is already in operation. Transducers for oil color, sodium content, and free fatty acid concentration have been constructed; both crude and refined oils are being analyzed. Provision has been made to perform the same analyses at later stages of processing on the bleached, hydrogenated, and deodorized oils. Under Phase I of implementing computer control, electronic signals from the analytical transducers are sent to the computer via appropriate interfacing hardware, and results are returned to the operator via teletype. Phase II will involve monitoring by the computer but with decision making and instructions to an operator, and Phase III will involve "closing the loop," that is, having the computer directly control the process. Development of transducers, software, and hardware as described here for the mini-refinery should facilitate subsequent implementation of computer control on a plant scale.

3394 • Hydrogenation of Soybean Oil with Copper Catalysts Containing Small Amounts of Nickel Catalysts

K. J. Moulton, R. E. Beal, and E. L. Griffin

J. Amer. Oil Chem. Soc. 50(11): 450-454. November 1973

Reaction rates, linolenate/linoleate reaction selectivity, *trans* formation, and conjugated diene formation were determined for mixed commercial catalysts containing 0.5, 1, 2, 10, and 20 parts nickel catalyst (25% nickel) per 1,000 parts copper chromite catalyst (p.p.t.) and at catalyst concentrations in the oil of 1.0, 0.5, and 0.25%. The rate of hydrogenation increased as the amount of nickel increased. Addition of 0.5, 1, and 2 p.p.t. nickel catalyst to copper chromite catalyst resulted in a small decrease in selectivity compared with straight copper chromite. When soybean oil was hydrogenated with these mixed catalysts sufficiently to reduce linolenate to 0, iodine values were 102-108 compared to 109-112 for straight copper chromite and to less than 80 for straight nickel.

3395 • Hydroformylation of Methyl Oleate with a Recycled Rhodium Catalyst and Estimated Costs for a Batch Process

J. P. Friedrich, G. R. List, and V. E. Sohns

J. Amer. Oil Chem. Soc. 50(11): 455-458. November 1973

Methyl oleate was hydroformylated to methyl formylstearate at 120° C. and 850-900 p.s.i.g. with a 1:1 mol mixture of hydrogen and carbon monoxide. In the presence of triphenylphosphite, an activated rhodium-on-alumina catalyst produced an essentially quantitative conversion in about 40 minutes. Filtration followed by distillation yielded methyl formylstearate. The solubilized rhodium catalyst was concentrated in the distillation residue. The residue was resupported on the spent support in a gas-fired rotary kiln. The process was repeated 9 times without significant loss of catalyst activity. Assuming the catalyst can be recycled repeatedly to the process without affecting the efficiency of operation, a preliminary estimate based on a hypothetical plant producing 2 million pounds of methyl formylstearate annually placed the processing costs, not including cost for methyl oleate, at about 13.7 cents per pound.

3396 • Acetylenic Acids of *Alvaradoa amorphoides* Seed Oil

M. B. Pearl, R. Kleiman, and F. R. Earle

Lipids 8(11): 627-630. November 1973

Oil from the seed of *Alvaradoa amorphoides* Liebm. (Simaroubaceae) collected in Mexico contains two acetylenic fatty acids previously unknown in seed oils, 15% of 17-octadecen-6-yneic and a trace amount of 6-eicosyneic acid. The predominant fatty acid (58%) in the oil is 6-octadecenoic (tariric). Both the Δ6 and Δ9 series of hexadecenoic, octadecenoic, octadecadienoic, and octadecatrienoic acids were found, but only the Δ6 isomer of eicosenoic

acid (1.4%) was detected. The mono- and dienoic acids make up about 19% of the total oil. The remainder consists mostly of saturated acids (6.3%). Techniques used in isolation and identification of the acids included thin-layer and gas chromatography, infrared, ultraviolet, nuclear magnetic resonance and mass spectroscopy, and ozonolysis coupled with gas chromatography.

3397 • Mass Chromatographic Analysis of Volatiles

Alan C. Lansen, J. O. Ernst, W. F. Kwolek,¹ and H. J. Dutton

(¹Biometrician, North Central Region, ARS, USDA, Peoria, Ill.)

Anal. Chem. 45(14): 2344-2348. December 1973

A gas chromatographic method for determining molecular weights, called mass chromatography, has particular interest for the lipid chemist. The equipment differs from the familiar dual-compensating gas chromatograph; different carrier gases are used in each column and the "forgotten ideal" gas density balances serve as detectors in independent mode.

Molecular weights are calculated from detector responses for the same component eluted from identical columns with different carrier gases. An analysis of errors, precision, and accuracy of the method has been made. A typical example of application in lipid chemistry illustrates the complementary roles of mass chromatography and mass spectroscopy in compound identification.

3398 • Neural Disturbances in Chickens Caused by Dietary T-2 Toxin

R. D. Wyatt,¹ W. M. Colwell,¹ P. B. Hamilton,¹ and

H. R. Burmeister

(¹North Carolina State University, Raleigh)

Appl. Microbiol. 26(5): 757-761. November 1973

Graded concentrations of dietary T-2 toxin (0, 1, 2, 4, 8, and 16 µg./g.) were fed to groups of 40 chickens. T-2 toxin caused an abnormal positioning of the wings, brought on hysteroid seizures, and impaired righting reflex in young chickens. The abnormal wing positioning occurred spontaneously or as the result of dropping from a height of 1 meter. The seizures could be elicited by rough handling or loud noises. The seizures and the abnormal wing posture would not occur again when the stimulus was repeated unless a rest period of 3 to 6 hours was allowed. The loss of righting reflex could be demonstrated at any time. The total incidence of neural symptoms depended on the length of exposure to T-2 toxin and to its concentration. Neural toxicity occurred at dosages of 4, 8, and 16 µg. per gram of diet, which are the same doses that retard growth. This neural toxicity of T-2 toxin in chickens is similar to the neural disturbances associated with alimentary toxic aleukia, a nutritional toxicosis of humans produced by eating moldy grain. T-2 toxin has been implicated also in moldy corn toxicosis, which has neural manifestations in horses and swine.

3399 • Mass Propagation of Conidia from Several *Aspergillus* and *Penicillium* Species

G. A. Sansing and A. Ciegler

Appl. Microbiol. 26(5): 830-831. November 1973

A rapid technique is described for propagation, harvest, and purification of gram quantities of conidia of five *Aspergillus* and six *Penicillium* species.

3400* • Natural Sulfur Compounds

C. H. VanEtten and I. A. Wolff

In "Toxicants Occurring Naturally in Foods," 2nd ed., chap. 10, pp. 210-234. National Academy of Sciences, Washington, D.C. 1973

Some domestic plants have sulfur-containing compounds that may be harmful if consumed in large amounts. These compounds include thiocyanate ion, mustard oils, goitrins, and organic nitriles--all of which are enzymic hydrolysis products from precursor glucosinolates found in such crucifer plants as cabbage, turnip, kale, radish, horseradish, mustard seed, and rapeseed. Also, organic sulfides and related compounds are formed from S-substituted cysteine sulfoxides by enzyme action in onions, garlic, and chives. All those compounds add to the flavor of many edible vegetables and condiments. They cause no harm when consumed in conventional amounts. When the isolated compounds or fractions containing them are fed to experimental animals in larger amounts, however, they are toxic and show goitrogenic and other harmful biological responses.

3401 • Aqua Ammonia's Economic Potential as a Preservative for Stored High-Moisture Corn

Clarence A. Moore,¹ E. B. Lancaster, and R. J. Bothast

(¹Economic Research Service, USDA, Peoria, Ill.)

Econ. Res. Serv., U.S. Dept. Agr., ERS-535, 19 pp. October 1973

Potential demand for treatment of onfarm stored corn is sufficient to justify a profitable local supply of aqua ammonia by farm supply firms that operate convertor units. A 500-ton (considered a minimum) seasonal output would necessitate about a \$30 per ton supply price delivered at the farm. The supply price could decrease to about \$22 per ton at a 4,000-ton output (maximum for small convertor plants). Aqua ammonia treatment costs would amount to only about one-third the usual drying costs and one-fourth to one-fifth the cost of treatment with organic chemicals. Additional potential advantages include: (1) less care and movement of stored grain, (2) added nonprotein nitrogen to stored grain, and (3) savings of the critically short gas energy used for drying.

3402 • Dry Milling of Corn Artificially Dried at Various Temperatures
 O. L. Brekke, E. L. Griffin, Jr., and Gene C. Shove¹
 (¹University of Illinois, Urbana, Ill.)
 Trans. ASAE 16(4): 761-765. July-August 1973

Dry-milling quality of artificially dried corn as measured by yield and fat content of -3 $\frac{1}{2}$ +16-mesh grits (or the prime product mix) generally decreased as temperature of the drying air increased from ambient (35-60° F.) to 290° F. Product quality, based principally on amylograph cold paste viscosity, was also adversely affected as temperature of the drying air increased. Sharp increases in cold paste viscosity occurred over the 100-200° F. range, and viscosity of degermer fines was affected more than of low-fat flour, grits, or corn.

While ambient air drying gave corn having the best dry-milling quality, heated air drying at air temperatures up to 140° F. in the experimental fluidized-bed dryer produced corn of reasonably good quality except for a high percentage of stress cracks.

Because time, temperature, and corn moisture relationships vary among dryers of different types and sizes, the temperature limitation determined in this work will not necessarily apply directly to other dryers. However, the general effect of increasing the drying temperature is considered applicable.

A secondary conclusion from this investigation, but one of particular import to millers, is that yield and fat content of products were influenced by the method used to fractionate degermer stock. The flotation procedure produced a product of lower fat content and of comparable or higher yield than did the roller milling procedure. The results point to the potential to improve rolling and grading as we used the system.

3403 • Soda Pulps from Kenaf Bark and from Core
 G. F. Touzinsky, T. F. Clark, W. H. Tallent, and W. F. Kwolek¹
 (¹Biometrician, North Central Region, ARS, USDA, Peoria, Ill.)
 In "Non-Wood Plant Fiber Pulping Progress Report No. 4," TAPPI CA Report No. 52, pp. 49-53. 1973

Soda pulps were prepared from both wet-cleaned bark and woody core of kenaf, *Hibiscus cannabinus*, under various combinations of active alkali and cooking time at 170° C.; these pulps were evaluated to determine cooking conditions to realize optimal pulping behavior and pulp characteristics. Bark material cooked readily to produce pulps with 1% or less rejects and Kappa numbers below 22 at 15% or greater active alkali and 1.5 hours or longer cooking time. To achieve a similar degree of cooking, core material required either 18% active alkali and 2 hours or 21% active alkali and 1 hour. Preferred cooking conditions (active alkali and time) for optimal pulp characteristics, other than strength, could be selected from mathematical equations developed

statistically from experimental data. Experimental results and calculated values for three pulps (two from bark and one from core) prepared under conditions selected by use of these equations correlated well to demonstrate the validity of the equations.

3404 • Hexane-Alcohol Azeotrope Extraction of Soybeans: Chemical and Organoleptic Evaluation

Joseph J. Rackis, Arthur C. Eldridge, Judith E. Kalbrener,
David H. Honig, and David J. Sessa
AIChE Symp. Ser. 69(132): 1973

Commercial edible-grade soy products in the United States are prepared from hexane-defatted flakes. Flavor of these products prevents their use in bland food systems. Studies now indicate that reextraction of defatted flakes with hexane:alcohol azeotrope mixtures improves the flavor. These mixtures effectively remove residual bound lipids, which are primarily responsible for the undesirable flavors in soy products. Flavor scores of hexane:ethanol azeotrope-extracted flakes and proteinates prepared from these extracted flakes are significantly higher than those prepared by present commercial practices.

3405 • Uniform Quality Pulps from Wet-Processed Stored Green Kenaf

M. O. Bagby, T. F. Clark, and R. L. Cunningham

*In "Non-Wood Plant Fiber Pulping Progress Report No. 4,"
TAPPI CA Report No. 52, pp. 61-67. 1973*

Both foliated and defoliated green kenaf and its separated bark and woody core were stored for 9 months anaerobically either as-is or in the presence of propionic acid or borax. After storage, the preserved solids were wet-cleaned and evaluated. Recovery of the cleaned residues ranged from 52 to 73% with no completely consistent trends discernible. But wet cleaning tended to equalize compositions of materials recovered from foliated and defoliated kenaf regardless of storage history. Compared with the original materials, cleaned residues recovered from storage contained from 20 to 40% more cellulose, pentosan, and lignin combined and correspondingly less extractives, nitrogen, and ash. Relative pH values of spent liquors indicated that less caustic was consumed by cleaned storage residues than by unstored materials. Ready bleachability of pulps from cleaned residues was indicated by their low Kappa numbers and verified by their reduced demand for bleaching chemicals.

3406 • Water-Insoluble Starch Xanthate. Preparation and Use in Heavy Metal Recovery

[R. E. Wing]

North. Reg. Res. Lab., U.S. Agr. Res. Serv., CA-NRRL-41,
4 pp. November 1973 [Processed]

A water-insoluble starch xanthate offers industry a low-cost product that removes and recovers heavy metals from wastewater. Previously, heavy metals had been effectively removed with a starch xanthate-cationic polymer complex that allows metal recovery, but almost all cationic polymers are expensive. More traditional removal methods based on inorganic precipitation with lime, alum, or iron salts leave a sludge often placed in landfills. Leaching of the unrecovered metal to underground water and loss of metal resources result. Although precipitation as inorganic salts is inexpensive, recovery of the heavy metal for recycling is difficult.

Starch xanthate made from unmodified corn or wheat starch is water soluble. Starch xanthate itself precipitates large amounts of mercury(II), but because almost all other metal xanthate salts are more soluble, removal is not so efficient as when a cationic polymer is included. The efficiencies of metal removal by starch xanthate alone can be greatly increased if the initial starch is crosslinked. Xanthation of a highly crosslinked starch gives an insoluble product. An insoluble starch xanthate lowers the concentration of practically all metals to levels below strict discharge limits.

3407* • Rapid Screening Methods for Detecting Aflatoxin Contamination
Odette L. Shotwell

Proc. 21st Annu. Mtg. Amer. Ass. Feed Microscopists, Denver,
Colo., pp. 87-93. June 1973

Methods of aflatoxin analysis fall into three categories: (1) visual inspection of commodities under black light or ultraviolet light (365 nm.) serves to locate lots that may contain aflatoxin; (2) rapid screening procedures determine the presence or absence of the toxin, but not the amount present; and (3) rather lengthy procedures are available to measure how much is in agricultural commodities. The reliability of any analytical method for aflatoxin in corn depends on the size sample taken and how it is taken.

3408* • Economic Considerations in Industrial Utilization of Cereals
Clarence A. Moore¹ and Kenneth R. Majors²

(¹Economic Research Service, USDA, Peoria, Ill.; ²Extension Service, USDA, Peoria, Ill.)

In "Industrial Uses of Cereals," Y. Pomeranz, chairman,
Symp. Proc. Amer. Ass. Cereal Chem., St. Louis, Mo., Nov. 4-8,
1973, pp. 1-19. 1973

The grain portion of the cereal plant, though small, dominates its commercial use. Other parts are generally considered as waste residue and their disposal a problem rather than a potential. Future emphasis may be on developing useful products from cereal residues as the nation moves toward considering waste a luxury the economy can ill afford. Only 2-3% of the cereal grain produced finds industrial markets but this small portion exerts

a greater than proportionate impact on pricing in grain markets. Industrial use is predominantly of wet-milled starch, corn starch furnishing some 97% of the total cereal starch supply. The paper and paperboard industry takes almost 80% of the cereal starch going to industrial use. This concentration by industry in both supply and demand is in contrast to the almost endless number of (1) forms in which the cereals are used and (2) applications and functions they perform in industrial processes.

To relate starch demand to GNP is fallacy. Corn starch gained large markets because it (1) is relatively low-priced, (2) is versatile in use, (3) is a multi-functional "workhorse" type of material, (4) has production and geographic location advantages over other raw materials, (5) has cost, stable supply, and both manufacturer and user know-how advantages due to economy of scale, and (6) has benefitted from results of substantial industry and public research. In general, starch competes better in processes that require a temporary rather than a permanent function, and in uses that require "process functionality" rather than "end-product functionality." Cereal grain products' strongest competitor in industrial uses is the synthetic resins. A major competitive battleground of natural versus synthetic materials is a single-function peak performance in contrast to multi-function acceptable performance.

3409* • Cereal Grains as a Source of Industrial Energy

Dwight L. Miller

*In "Industrial Uses of Cereals," Y. Pomeranz, chairman,
Symp. Proc. Amer. Ass. Cereal Chem., St. Louis, Mo., Nov. 4-8,
1973, pp. 252-256. 1973*

Traditional domestic energy fuels, such as oil, gas, and coal, are becoming more expensive and increasingly in short supply. Alternate sources of energy are needed if the industrial energy demand by 1985, predicted as double the 1972 consumption of about 70 quadrillion BTU's, is to be met. Cereal crops convert and store solar energy in usable forms.

Although agricultural products represent renewable energy sources, cereal grains have received little attention. The energy potentials they offer now justify major consideration and re-evaluation.

Normally, U.S. agriculture first provides food, feed, and fiber--markets that provide the highest financial return. U.S. agriculture has the capability to produce in excess of domestic needs. Through barter for traditional energy fuels, or through conversion (i.e., fermentation) into readily usable forms (i.e., alcohol), major contributions to industrial energy requirements are possible.

3410* • Industrial Use of Corn Starch

C. R. Russell

*In "Industrial Uses of Cereals," Y. Pomeranz, chairman,
Symp. Proc. Amer. Ass. Cereal Chem., St. Louis, Mo., Nov. 4-8,
1973, pp. 262-284. 1973*

Current domestic consumption of corn starch products, including unmodified and modified starches, in industrial or nonfood applications amounts to approximately 3 billion pounds per year. About 90% of this volume is accounted for by starch products used as sizing agents and adhesives in making and coating paper and paperboard; as sizes in the manufacture of textiles; and as adhesives in producing boxboard, insulation board, paper bags, cardboard cartons, and gummed labels and tapes. Information presented that relates to the manufacture of starch products and their use in industrial applications covers: types and amounts of principal starch products, their preparation and properties, and the technology involved in their end-use applications. In addition, a number of industrially promising developmental products are discussed, including graft polymers of starch and starch-based additives for rubber.

3411* • Corn Proteins: Potential for Their Industrial Use

R. A. Reiners,¹ J. S. Wall, and G. E. Inglett

(¹CPC International, Inc., Moffett Technical Center, Argo, Ill.)
*In "Industrial Uses of Cereals," Y. Pomeranz, chairman,
Symp. Proc. Amer. Ass. Cereal Chem., St. Louis, Mo., Nov. 4-8,
1973, pp. 285-302. 1973*

The industrial use of corn proteins is small but growing. Zein sales are increasing, and the prospect is that they will continue to rise as further penetration is made into the tablet-coating market. New knowledge of the structure of the glutelin residue left after zein extraction may lead to industrial use of this major corn protein.

3412* • Aflatoxin Removal or Inactivation in Selected Commodities

Alex Ciegler

Proc. N. Car. Anim. Nutr. Conf., Raleigh, pp. D-1 to D-6.
December 5-6, 1973

Approaches to detoxification of aflatoxin-contaminated feed commodities can be divided into three categories: physical, chemical, and biological. The method of choice may be governed by the commodity, by its physical state, and by economics. Current technology indicates that physical separation and ammoniation hold the most promise for detoxification of specific commodities. However, ammoniation still requires additional research, plus clearance by Food and Drug Administration, before final recommendations can be made.

3413 • Mycotoxin Formation Affected by Fumigation of Wheat
E. E. Vandegraft, O. L. Shotwell, M. L. Smith, and
C. W. Hesseltine
Cereal Sci. Today 18(12): 412-416. December 1973

Fumigation both increased and decreased aflatoxin and ochratoxin production depending on fungal strain with which the wheat had been inoculated--*Aspergillus flavus*, *A. parasiticus*, *A. ochraceus*, or *Penicillium viridicatum*. Out of eight fungal strains, six were affected by methyl bromide, five by DDVP [*O,O*-dimethyl *O*-(2,2-dichlorovinyl) phosphate], four by ethylene dichloride:carbon tetrachloride, and one by chloropicrin. In some experiments sterilization of the wheat by autoclaving after fumigation influenced results. Whereas some effects in mycotoxin production were statistically significant with fumigated wheat, these probably have no practical significance. Although some insecticides do inhibit either mold growth or mycotoxin production, or both, their effect lasts only a short while.

3414 • Aflatoxin and Anthraquinone Biosynthesis by Nitrosoguanidine-Derived Mutants of *Aspergillus parasiticus*
R. W. Detry, S. Freer, and A. Ciegler
Can. J. Microbiol. 19(11): 1373-1378. November 1973

The mutagen *N*-methyl-*N'*-nitro-*N*-nitrosoguanidine (NG) produced mutants of *Aspergillus parasiticus* NRRL 2999 that have an altered secondary biosynthesis capacity and nutritional requirements. Incubation of *A. parasiticus* (1×10^8) spores in 0.02% nitrosoguanidine for 60 minutes resulted in induced nutritional auxotrophs to a maximum frequency of 8% at 5% survival. Some 0.5% of the 5% survivors lacked the ability to synthesize aflatoxin; however, no other fluorescent metabolites were detected from these mutants. Another group of mutants was isolated that gave a red anthraquinone, subsequently identified as norsolorinic acid (NOR) and representing up to 3-4% of the mycelial dry weight mass. The wild-type high aflatoxin-producing strain yielded a small quantity of this pigment; however, all the NOR mutants synthesized limited amounts of aflatoxin B₁ or none at all. Further mutagenesis of NOR mutants resulted in survivors still with reduced aflatoxin elaboration ability. These mutants also gave small quantities of the methoxylated pigment, solorinic acid. The wild-type *A. parasiticus* NRRL 2999 strain yields 50 times more aflatoxin B₁ than NOR pigment, whereas the derived NOR mutants synthesized 100 to 200 times more NOR than aflatoxin B₁. The synthesis of NOR in the induced NOR mutants paralleled growth, whereas aflatoxin B₁ production occurs typically as growth begins to decline (biphasic synthesis). Such data indicate a possible metabolic block of secondary biosynthesis in NOR mutants since both NOR and aflatoxin B₁ are acetate-derived polyketide metabolites.

3415 • Relationship Between the Biosynthesis of Virus-Like Particles and Mycophenolic Acid in *Penicillium stoloniferum* and *Penicillium brevi-compactum*
R. W. Dstroy, S. N. Freer, and D. I. Fennell
Can. J. Microbiol. 19(11): 1459-1462. November 1973

Several strains of *Penicillium stoloniferum* and *P. brevi-compactum* containing no viruslike particles (VLP) synthesize mycophenolic acid (MA), an antiviral metabolite; one strain of *P. stoloniferum* producing more than 600 µg. VLP per gram dry weight mycelia synthesized no detectable MA. However, one strain of *P. brevi-compactum* produced 5 µg. VLP per gram of dry weight plus MA. Preliminary data suggest that MA may act as an antivirus in controlling fungal virus infection or its replication, or both.

3416 • The Effects of T-2 Toxin in Broiler Chickens
R. D. Wyatt,¹ P. B. Hamilton,¹ and H. R. Burmeister
(¹North Carolina State University, Raleigh)
Poultry Sci. 52(5): 1853-1859. September 1973

T-2 toxin is a mycotoxin produced by several species of *Fusarium*, and small concentrations have been reported earlier to cause severe oral lesions in chickens. Graded concentrations (0, 1, 2, 4, 8, and 16 µg./g.) of dietary T-2 toxin were given to groups of 40 broiler chickens. A total of 240 chicks were used in these experiments. The growth rate was reduced significantly ($P<0.05$) by concentrations of 4, 8, and 16 µg./g. but not by lower concentrations, whereas the feed conversion ratios were unaffected by any concentrations. The relative weight of the spleen was decreased and the relative weight of the pancreas was increased by the growth inhibitory concentrations. The bursa of Fabricius was reduced in relative weight by concentrations of 8 and 16 µg./g. while the relative weight of the crop was increased. The relative weight of the liver was unaffected as was its lipid content and its percent of dry matter; however, there was a dose-related increase in liver hematomas. The hemoglobin, serum proteins, serum cholesterol, serum total lipids, plasma glucose, and plasma uric acid were unaffected as were the capillary fragility, lateral shear strength of breast muscle, and liver acid phosphatase which is a marker enzyme of lysosomes. These data suggest that severe oral lesions which impair their ability to eat are the primary effect of T-2 toxin in chickens. Secondarily with greater concentrations, T-2 toxin exerts its systemic effects on the chickens.

3417 • Virus Particles from Conidia of *Penicillium* Species

G. A. Sansing, R. W. Detry, S. N. Freer, and C. W. Hesseltine
Appl. Microbiol. 26(6): 914-918. December 1973

Virus particles and their component double-stranded ribonucleic acid (dsRNA) have been isolated from conidia and mycelia of certain *Penicillium* species. The conidia and mycelia of *P. stoloniferum* NRRL 5267 contained 75 and 85 µg. of dsRNA/g. (dry weight), respectively. Of the total dsRNA released from NRRL 5267 conidia, 10% was nonencapsulated. Conidia of *P. brevi-compactum* NRRL 5260 and *P. chrysogenum* Q-176 contained 2 and 120 µg. of dsRNA/g. (dry weight), respectively, whereas mycelium from the two species contained 3 and 95 µg. of dsRNA/g. (dry weight), respectively. No viruses were isolated from conidia or mycelia of *P. stoloniferum* NRRL 859. A method is described for disruption of both conidia and mycelia. The technique facilitates the isolation and characterization of fungal viruses and their component dsRNA and also potentiates surveying of fungal isolates for the presence of virus.

3418 • Scanning Electron Microscopy of Bacterial Colonies

Evrik G. Afrikian, Grant St. Julian, and Lee A. Bulla, Jr.
Appl. Microbiol. 26(6): 934-937. December 1973

A technique is described for observing bacterial colony growth. *Bacillus cereus*, *B. subtilis*, and *B. cereus* var. *mycoides* were grown on strips of dialysis membrane layered on nutrient agar. Microcolonies of the organisms on strips were fixed in Formalin vapor *in situ*; the strips then were removed from the agar and secured to scanning microscope specimen stubs without markedly disturbing the cellular arrangement. Scanning electron micrographs clearly depict morphology of individual cells, as well as the spatial orientation of cells within the colony. This technique is reproducible, adaptable, and simple.

3419 • Isolation of the Emetic Principle from *Fusarium*-Infected Corn

R. F. Vesonder, A. Ciegler, and A. H. Jensen¹

(¹University of Illinois, Urbana)

Appl. Microbiol. 26(6): 1008-1010. December 1973

A mycotoxin responsible for vomiting in swine has been isolated from *Fusarium*-contaminated field corn. The compound was tentatively identified as a trichothecene, 3,7,15-trihydroxy-12,13-epoxy-trichothe-9-en-8-one, and has been given the trivial name vomitoxin.

3420* • Mucorales

C. W. Hesseltine and J. J. Ellis

In "The Fungi. An Advanced Treatise," eds. G. C. Ainsworth, F. K. Sparrow, and A. S. Sussman, vol. 4B, chap. 11, pp. 187-217. New York. 1973

In a book on the classification of all fungi, this chapter describes the order, gives the most important taxonomic literature, presents a key for the identification of the valid genera, and lists all the genera ever described for the Mucorales.

3421 • Feed Sources and Conditions Conducive to Production of Aflatoxin, Ochratoxin, *Fusarium* Toxins, and Zearalenone

E. B. Lillehoj

J. Amer. Vet. Med. Ass. 163(11): 1281-1284. December 1973

This review covers various critical factors related to mold development and mycotoxin production. Of fundamental importance is the moisture content of the substrate; field fungi develop at 22-25% moisture, whereas storage molds are encountered on stored grains at 13-18% moisture. Temperature limits growth of many species, whereas others develop from below freezing to 60° C. Other factors modifying mold growth are aeration, substrate, genetic properties of the organism, and primary inoculum. Environmental factors exerting influence on mold development have been intensively studied in *Aspergillus flavus* growth and elaboration of aflatoxin. Similar studies have been carried out on the *Fusarium* toxins, particularly T-2 and zearalenone. Various techniques for controlling molds are considered with particular emphasis on adequate drying procedures in grains and oilseeds.

3422 • Gas-Liquid Chromatographic Determination of Rotenone and Deguelin in Plant Extracts and Commercial Insecticides

Norman E. Delfel

J. Ass. Off. Anal. Chem. 56(6): 1343-1349. November 1973

Retention times on 3% methyl silicone in glass columns at 160° C. were 0.85 and 1.39, respectively, for deguelin and stigmasterol acetate, the internal standard; flame ionization detector responses were 1.00 and 1.47, respectively, compared to rotenone as 1.00 for both. When present, rotenolone interfered with the determination of deguelin. Rotenoid extracts from *Derris elliptica* and *Lonchocarpus nicou* roots lacked other interfering materials. *Tephrosia vogelii* leaflets contained fat-soluble contaminants that were minimized by using acetonitrile for extraction and

by subsequent partitioning with hexane. When the gas-liquid chromatography (GLC) assay was applied to commercial samples, rotenone results were comparable to label values in two samples and rotenoid oxidation products were detected in two others. The precision of GLC was $\pm 4.1\%$, and the results agreed with those by thin-layer densitometry (TLD) within 2.1% for rotenone and 2.9% for deguelin. A minor improvement of TLD for analysis of *T. vogelii* extracts is also described.

3423* • Saponification and Gas Chromatographic Analysis of Jojoba Wax Esters

Thomas K. Miwa

In "Jojoba and Its Uses," Proc. Int. Conf., University of Arizona, Tucson, eds. Edward F. Haase and William G. McGinnies, pp. 61-72. June 1972

Jojoba liquid wax esters are extraordinarily resistant to any manner of direct saponification. Total conversion to free acids and alcohols is impossible unless the wax esters are initially transformed into intermediates that are conducive to saponification. For example, HCl-catalyzed interesterification of the wax esters with ethanol yields ethyl esters and free alcohols, which can then be treated with ethanolic KOH (containing water) to give a fatty acid salt-fatty alcohol mixture. Meticulous care must be exercised to separate the acids completely from the alcohols. Emulsification is prevented by moderately shaking the two-phase system during early stages of an exhaustive 59-step separation scheme that requires a full workday per sample. Nevertheless, with only two separatory funnels, the scheme allows same separation as automatic countercurrent distribution.

3424 • Recent Research for the Control of Mycotoxins in Cereal

C. W. Hesseltine

Pure Appl. Chem. 35(3): 251-257. 1973

This paper briefly reviews several areas of research at the Northern Regional Research Laboratory. The first study involves the effects of insecticide treatment of sterile and unsterile wheat on the formation of aflatoxin and ochratoxin. In at least one treatment, increased yields were observed (carbon tetrachloride-carbon disulphide). The second study concerns our recent surveys on incidence of ochratoxin, aflatoxin, and zearalenone in white and yellow corn (maize). An aflatoxin problem of some magnitude existed in 1971 in the southern part of the U.S., even though only 4% of the yearly corn production comes from this region. The third aspect covers the numbers of species of *Aspergillus* and *Penicillium* that produce penicillic acid and ochratoxin. Ochratoxin is now known to be produced by the following species of *Aspergillus*: *sulphureus*, *sclerotiorum*, *alliaceus*,

melleus, *ostianus*, *pentrakii*, and *ochraceus*; also by the following species of *Penicillium*: *viridicatum*, *commune*, *cyclopium*, *purpureescens*, and *variable*. The fourth study deals with the effect of ammonia treatment on a laboratory scale on the internal mold flora of corn.

3425 • New Methods for Rapid Detection of Aflatoxin

C. W. Hesseltine and O. Shotwell

Pure Appl. Chem. 35(3): 259-266. 1973

The rapid detection of mycotoxin contamination in agricultural commodities is an area of research that requires more attention. The many companies buying hundreds of bushels of cereal grains daily need to inspect their purchases immediately and to make a decision in minutes. Arising from this need to detect aflatoxin, we have developed two methods for rapid identification of aflatoxin in corn. The first is based upon a glowing greenish-gold fluorescence produced under ultraviolet light (365 nm) by corn kernels that contain aflatoxin. The fluorescent material is not aflatoxin but a compound associated with it. Fluorescence depends upon the interaction between enzymes in corn and a compound produced by members of the *Aspergillus flavus* series. Heat-sterilized corn inoculated with *A. parasiticus* does not fluoresce, although aflatoxin is formed. Fluorescence is seen in broken kernels but it is not visible in intact corn kernels until they are broken. Laboratory studies show that this method of detection is applicable for other cereals, including wheat, rice, oats and barley, but is apparently not effective for soybeans and peanuts. The second is a modification of the chromatographic mini-column method devised for corn.

3426 • Isolation and Characterization of Constituents in Hemolymph from Healthy and Diseased Japanese Beetle Larvae

Glenn A. Bennett and Odette L. Shotwell

Biotechnol. Bioeng. 15(6): 1023-1037. November 1973

Studies are reviewed on the composition of hemolymph from Japanese beetle larvae, *Popillia japonica*. This research was conducted to determine the chemical environment required for sporulation of the milky disease organism, *Bacillus popilliae*. Amino acids, proteins, organic acids, lipids, carbohydrates, and oxygen content were determined in hemolymph from healthy and diseased larvae. Oxygen content of hemolymph was measured by micro-electrodes implanted in the hemocoel of living larvae. Vegetative growth of the pathogen reduces the dissolved oxygen; however, as sporulation occurs, oxygen concentration approaches normal values. Trehalose, the major hemolymph sugar, is reduced about 50% during the course of milky disease. Neutral lipids, phospholipids, and hydrocarbons decrease markedly with infection. Both branched-chain and normal alkanes occur in hemolymph. Milky disease causes an increase in concentration of pyruvic, malic, glycolic,

tartaric, and glyoxylic acids. The major hemolymph protein, a lipoglycoprotein, has a molecular weight around 500,000. When the concentration of this protein is reduced, a smaller protein appears. Amino acids that increase significantly as a result of infection are: glutamic acid, aspartic acid, β -alanine, phenylalanine, threonine, lysine, and serine. Hemolymph contains few peptides of low molecular weight.

3427 • Binding of Papain to Dialdehyde Starch

F. B. Weakley and C. L. Mehlretter

Biotechnol. Bioeng. 15(6): 1189-1192. November 1973

Papain in crude form was covalently bound to polymeric dialdehyde starch and to crosslinked dialdehyde starch by direct reaction. Water-insoluble papain derivatives of low activity were obtained. However, the crosslinked dialdehyde starch-papain product, in particular, had the following advantages: (1) Ease of preparation at low cost, (2) good thermal stability and retention of activity, and (3) ready recovery by filtration or centrifugation for recycling.

3428* • Immobilized Enzymes

K. L. Smiley and G. W. Strandberg

Advan. Appl. Microbiol. 15: 13-38. 1972

Immobilized enzymes constitute a new class of heterogeneous catalysts with a high degree of specificity. They have potential application in medicine, food and industrial processing, waste treatment, and as research tools.

Water-insoluble enzymes are easily removable reagents that provide precise control over enzymatic reactions. In general, they are more stable under operating conditions than their soluble counterparts. Because they are readily recovered, they can be reused many times. Their insoluble nature makes it possible also to use them in continuous reactors.

There are four general methods of immobilizing enzymes: (1) They can be adsorbed on such materials as ion exchangers and clays. (2) They can be entrapped in gel lattices where they are physically restrained. (3) Enzymes can be covalently linked to an insoluble carrier through functional groups of the protein not involved in reactive sites. (4) Bifunctional reagents can crosslink the enzyme protein and cause insolubilization.

This review covers immobilization techniques, properties of immobilized enzymes, and possible applications of this new technology.

3429* • Scanning Electron Microscopy

Lee A. Bulla, Jr., Grant St. Julian, Clifford W. Hesseltine,
and Frederick L. Baker
Methods Microbiol. 8: 1-33. 1973

Presented is an insight into the usefulness of the scanning electron microscope in microbiology, a summary of the principles of scanning electron microscopy, a description of the methods for specimen preparation, and an outline of some microbial applications.

3430 • The Genus *Bacillus*

Ruth E. Gordon,¹ William C. Haynes, and C. Hor-Nay Pang¹
(¹Rutgers University, New Brunswick, N.J.)
U.S. Dept. Agr., Agr. Handb. No. 427, 283 pp. October 1973

This taxonomic study is based on a collection of 607 strains mainly from the American Type Culture Collection (ATCC). Representation of some species is augmented by strains from N. R. Smith's collection (NRS) and from the ARS Culture Collection, USDA (NRRL). Histories and examined characteristics of each strain are reported. Of the 607 strains, 530 are assigned to 18 species, and the 18 species are delineated. The remaining 77 strains, that may or may not represent additional species, are described but are listed as specifically unassigned until more strains are available for study. Two diagnostic keys are given to assist in the identification of isolates and the authentication of cultures. Indices 1 and 2 contain all the named strains of *Bacillus* spp. assembled for this handbook and all the named strains in the NRS Collection.

3431 • Syntheses of Methyl Ethers of Methyl α -D-Mannopyranoside,
and Hydrogen Bonding in Diastereoisomers of Methyl
 $4-O-(1\text{-Ethoxyethyl})-\alpha$ -D-Mannopyranoside

Fred R. Seymour
Carbohydr. Res. 30(2): 327-335. October 1973

The synthesis of the 4-methyl, the 2,4-dimethyl, and the 2,3,6-trimethyl ethers of methyl α -D-mannopyranoside has been accomplished by the use of selective, benzoyl protecting groups, the 1-ethoxyethyl protecting group, and methylation with diazomethane. Considerable differences were noted in the infrared and nuclear magnetic resonance spectroscopic and thin-layer chromatographic properties of the diastereoisomers of methyl 4-*O*-(1-ethoxyethyl)- α -D-mannopyranoside. A structure, analogous to that of *trans*-decalin, maintained by intramolecular hydrogen-bonding is proposed for these compounds. The differences in physical properties of the two diastereoisomers are interpreted on the basis that the (*R*) isomer has an axially attached methyl group, and, therefore, the ring involved cannot be so stable as that of the (*S*) isomer.

3432* • An Overview of Energy Consumption in Grain Utilization
Dwight L. Miller
Proc. Energy for Agr. Conf., Purdue University, Lafayette,
Indiana, September 18-19, pp. 141-145. 1973

Agricultural products are a major renewable source of energy. Agriculture has normally been included in the energy-producing sector of the U.S. economy. Overall, the production, processing, and distribution of agricultural crops consume more energy than they contribute. Power from machines, with major inputs from fossil fuels, has greatly increased agricultural production. Agriculture based primarily on human-animal power cannot provide the food and fiber for the United States. Maximum utilization of total materials, including byproducts and residues, is a future necessity to reduce the energy imbalance.

3433 • Liquid Scintillation Counting of Radioactive Monomeric and Polymeric Carbohydrates on Paper Chromatograms
Paul A. Sandford and Paul R. Watson
Anal. Biochem. 56(2): 443-449. December 1973

A simple, improved scintillation counting procedure was developed for the assay of radioactive mono- and polysaccharides on paper chromatograms. Segments of chromatograms are placed in scintillation vials and soaked in water to completely elute the carbohydrate before addition of Aquasol, a xylene-based scintillation fluid. The resulting water-Aquasol solution is counted in a liquid scintillation counter. Evaluation of numerous experimental variables revealed optimal conditions for complete elution of mono- and polysaccharides with water before counting in Aquasol.

The water elution-Aquasol procedure allows water-soluble substances (^{14}C - and ^3H -labeled) on paper to be assayed with increased accuracy and sensitivity (three- to fivefold improvement in counting efficiency of tritiated samples). The simplicity of the procedure allows entire radiochromatograms to be assayed readily.

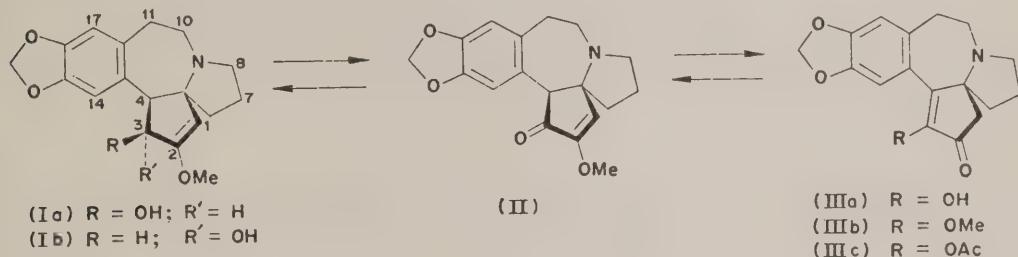
3434 • Filter Paper Assay--Effect of Time and Substrate Concentration on Cellulase Activity
H. L. Griffin
Anal. Biochem. 56(2): 621-625. December 1973

A reliable filter paper assay is described for the determination of cellulase activity in the range of 1-10 filter paper units. A single determination is required of the reducing sugar produced by digesting 100 mg. of filter paper substrate 30 minutes at 50° C. and pH 4.8 with 1 ml. each of 0.05 M sodium citrate buffer and the cellulase preparation.

3435 • Desmethylcephalotaxinone and Its Correlation
with Cephalotaxine

Richard G. Powell and Kenneth L. Mikolajczak
Phytochemistry 12(12): 2987-2991. December 1973

A new alkaloid, desmethylcephalotaxinone (IIIa) has been isolated from *Cephalotaxus harringtonia* (Forbes) K. Koch var. *harringtonia* cv. Fastigiata. Its structure has been established by spectral methods and by a partial synthesis from cephalotaxine (Ia) via cephalotaxinone (II). Methylation of IIIa with dimethoxypropane yields II along with some *iso*-cephalotaxinone (IIIb). Compound II was confirmed as a naturally occurring minor *Cephalotaxus* constituent. Reduction of II with sodium borohydride proceeds stereospecifically to give Ia.



REPUBLICATIONS

2822* • Perspektive Kukuruza [Corn in Perspective, pp. 1-5]
G. E. Inglett
In "Kukuruz: Kultura, Prerada, Proizvodi," ed. G. E. Inglett,
chap. 1, pp. 1-3. November 1972

2823* • Ekonomicnost: Proizvodnja I Prodaja [Economics: Production
and Marketing, pp. 84-122]
Clarence A. Moore¹ and Philip B. Dwoskin²
(¹USDA Marketing Economics Division, Peoria, Ill.; ²USDA
Marketing Economics Division, Washington, D.C.)
In "Kukuruz: Kultura, Prerada, Proizvodi," ed. G. E. Inglett,
chap. 6, pp. 18-21. November 1972

2824* • Struktura Zrna, Sastav I Kvalitet [Kernel Structure,
Composition, and Quality, pp. 123-137]
G. E. Inglett
In "Kukuruz: Kultura, Prerada, Proizvodi," ed. G. E. Inglett,
chap. 7, pp. 22-36. November 1972

2825* • Upotreba Kukuruza Za Ljudsku Ishranu U Svetu [Food Uses
of Corn Around the World, pp. 138-150]
G. E. Inglett
In "Kukuruz: Kultura, Prerada, Proizvodi," ed. G. E. Inglett,
chap. 8, pp. 37-44. November 1972

2826* • Mokro Mlevenje Kukuruza [Corn Wet Milling Industry, pp. 151-170]
Roy A. Anderson
In "Kukuruz: Kultura, Prerada, Proizvodi," ed. G. E. Inglett,
chap. 9, pp. 45-47. November 1972

2827* • Industrijs Suvog Mlevenja Kukuruza [Corn Dry Milling
Industry, pp. 262-291]
O. L. Brekke
In "Kukuruz: Kultura, Prerada, Proizvodi," ed. G. E. Inglett,
chap. 14, pp. 55-87. November 1972

2828* • Industrija Fermentacije I Destilacije [Fermentation and Distilling Industries, pp. 307-313]
G. E. Inglett
In "Kukuruz: Kultura, Prerada, Proizvodi," ed. G. E. Inglett, chap. 16, pp. 102-107. November 1972

The book "Corn: Culture, Processing, Products," edited by G. E. Inglett, was published in 1970. This work was partially translated into Yugoslavian (with exception of chapters 2, 5, 10, 12, 13, and 17). English titles and original page numbers are given in brackets for the seven translated chapters contributed by NRRL scientists.

3224* • Aflatoxin
R. J. Bothast
Food & Beverage--Grain Industries Plants, pp. 13-15. July 1973

This article originally was published in September 1972 under the title "Aflatoxin--What Causes It, How To Identify It, and What To Do With It," in the Proceedings of the Grain Quality Conference on Aflatoxin and Air Pollution Control, held at Iowa State University, Ames, July 27, 1972, pp. 9-16.

3260* • Soyabean...King of the Oilseeds
J. C. Cowan
World Farming 15: 17-21. July 1973

This article originally was published under the title "Soybeans. Their Uses Are Many and Expanding All the Time" in Crops & Soils 25(5): 10-14, February 1973.

3432* • There Is No Need for a Fuel Shortage
Dwight L. Miller
Grain Farm Serv. Cent. 130(11): 11-13. November 1973

This paper was originally published in the Proceedings of the Energy for Agriculture Conference, Purdue University, Lafayette, Indiana, September 18-19, 1973, pp. 141-145, under the title "An Overview of Energy Consumption in Grain Utilization."

UNOFFICIAL PUBLICATIONS

Listing of publications and patents of the Northern Regional Research Laboratory would not be complete without including some unofficial publications. These are writings by members of the Northern Laboratory staff, and, although written from previously published official material, are of a public service value from the standpoint of review and updating of the literature. Reprints are not available at the Northern Regional Research Laboratory for distribution.

Processing of Polyimidazopyrrolone Polymers at High Temperature

E. B. Bagley, C. L. Johnson,¹ and T. L. Tolbert²

(¹6238 Rolling Water, Houston, Tex.; ²Monsanto Industrial Chemicals Company, Akron, Ohio)

Appl. Polym. Symp. No. 20: 315-323. 1973

Internal Pressure of Liquids and Their Relationship to the Enthalpies and Entropies of Mixing in Nonelectrolyte Solutions

E. B. Bagley, T. P. Nelson,¹ and J. M. Scigiano²

(¹Esso Research and Engineering Co., Florham Park, N.J.; ²Monsanto Company, St. Louis, Mo.)

J. Phys. Chem. 77(23): 2794-2798. November 1973

CONTRACT AND GRANT RESEARCH PUBLICATIONS

[Report of research work done by an outside agency under contract with the U.S. Department of Agriculture and supervised by the Northern Regional Research Laboratory.]

259-C* • Starch Particles in Enhancement of Iodine Extraction
Yoon Young Lee and George T. Tsao
Iowa State University, Ames
AIChE J. 19(4): 849-850. July 1973

261-C* • Rapid and Simple Method for the Quantitative Extraction of Corn Endosperm Proteins
Jose Madrid Concon
University of Kentucky Research Foundation, Lexington
Anal. Biochem. 55(2): 563-572. October 1973

[Report of research done by an outside agency under a grant from the U.S. Department of Agriculture and supervised by the Northern Regional Research Laboratory.]

135-G* • Debenylation of Carbohydrate Benzyl Ethers and Benzyl Glycosides Via Free-Radical Bromination
James N. BeMiller and Howard L. Muenchow
Southern Illinois University, Carbondale
Carbohydr. Res. 28(2): 253-262. June 1973

136-G* • Electrocatalysis and Related Studies on 2-Aminoacrylic Acid Derivatives. Part I. Electrocatalysis of 2-Acetamidocinnamic Acid
Duane N. Schluter, Gleb Mamantov, and John R. Vercellotti
University of Tennessee, Knoxville
J. Chem. Soc. Perk. Trans. 2(12): 1663-1669. 1973

137-G* • Electrocatalysis and Related Studies on 2-Aminoacrylic Acid Derivatives. Part II. Electrocatalysis of 2-Acetamidoacrylic Acid
Duane N. Schluter, Gleb Mamantov, and John R. Vercellotti
University of Tennessee, Knoxville
J. Chem. Soc. Perk. Trans. 2(12): 1670-1675. 1973

July-December 1973

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PATENTS

[These patents are assigned to the Secretary of Agriculture. Copies of patents may be purchased (50 cents each) from the Commissioner of Patents, U.S. Patent Office, Washington, D.C. 20231. Order by number, do not send stamps.]

Active Water-Insoluble Enzymes

Charles L. Mehltretter and Francis B. Weakley
U.S. Patent 3,745,088. July 10, 1973

Enzymes are insolubilized by coupling them to the diazotized anthranilates of modified and unmodified starch. These water-insoluble enzymes can be activated before each use by conventional means.

Catalyst for Selective Hydrogenation of Polyunsaturated Vegetable Oils

Sambasivarao Koritala
U.S. Patent 3,749,681. July 31, 1973

A catalyst is described which will selectively reduce the linolenate moiety of polyunsaturated vegetable oils. The catalyst is particularly characterized as having excellent reuse properties. A procedure for the preparation of this highly active catalyst by chemisorption of copper-ammonium complex on silica gel is also described.

Starch Xanthate-Polyamide-Polyamine Interpolymer Paper Strength Additives
George Earle Hamerstrand and Merle E. Carr
U.S. Patent 3,763,060. October 2, 1973

Crosslinked starch-polyamide-polyamine interpolymers are prepared and described. Wet- and dry-tensile, dry-burst, and concora crush strengths of paper products, prepared from both acid and alkaline pulp furnishes, are significantly increased by the wet-end addition of the interpolymers.

LICENSING OF PATENTS

Many inventions and discoveries of the Northern Laboratory are covered by patents assigned to the Secretary of Agriculture.

Assigned patents are available for use by business and industry under nonexclusive licenses. Conditions applicable to the granting of licenses are set

forth in the Federal Register, May 14, 1970 [35(94): 7493-7494]; however, exclusive licenses are not available. Further information can be obtained from the Administrator, Agricultural Research Service, U.S. Department of Agriculture, Washington, D.C. 20250.

The Northern Regional Research Laboratory is part of the Agricultural Research Service of the U.S. Department of Agriculture. Congress in 1938 authorized four regional laboratories to conduct broad and complex investigations in the field of chemistry and related physical sciences to expand and improve the marketability of agricultural commodities. A fifth laboratory was completed in 1969 at Athens, Georgia. The addresses and commodities covered are:

<u>Laboratory</u>	<u>Principal Fields of Research</u>
Eastern Regional Research Laboratory 600 East Mermaid Lane Philadelphia, Pennsylvania 19118	Animal fats; dairy products; deciduous fruits; hides and leather; maple sap and sirup; meat and meat byproducts; potatoes and other vegetables.
Northern Regional Research Laboratory 1815 North University Street Peoria, Illinois 61604	Cereal grains: corn, wheat, grain sorghum, barley, and oats; oilseeds: soybean, flaxseed, and erucic acid-containing oilseeds; and new crops.
Richard B. Russell Agricultural Research Center P. O. Box 5677 Athens, Georgia 30604	Southeastern poultry, fruits, and vegetables; pecans and peanuts; forages and feeds; sunflower as an oilseed; pork; and tobacco.
Southern Regional Research Laboratory P. O. Box 19687 New Orleans, Louisiana 70179	Cotton and cottonseed; peanuts; rice; sweet potatoes; and sugarcane.
Western Regional Research Laboratory Berkeley, California 94710	Western fruits, nuts, vegetables, oilseeds, and rice; poultry products; forage crops; wheat and barley; wool and mohair; dry beans and peas; castor; and safflower.

UNITED STATES DEPARTMENT OF AGRICULTURE
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1815 NORTH UNIVERSITY STREET
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